TECHNICAL MEMORANDUM 2.0

UPPER PENITENCIA CREEK BYPASS

HYDRAULIC ANALYSIS SUPPLMENT

Santa Clara Valley Water District

AUGUST 2001

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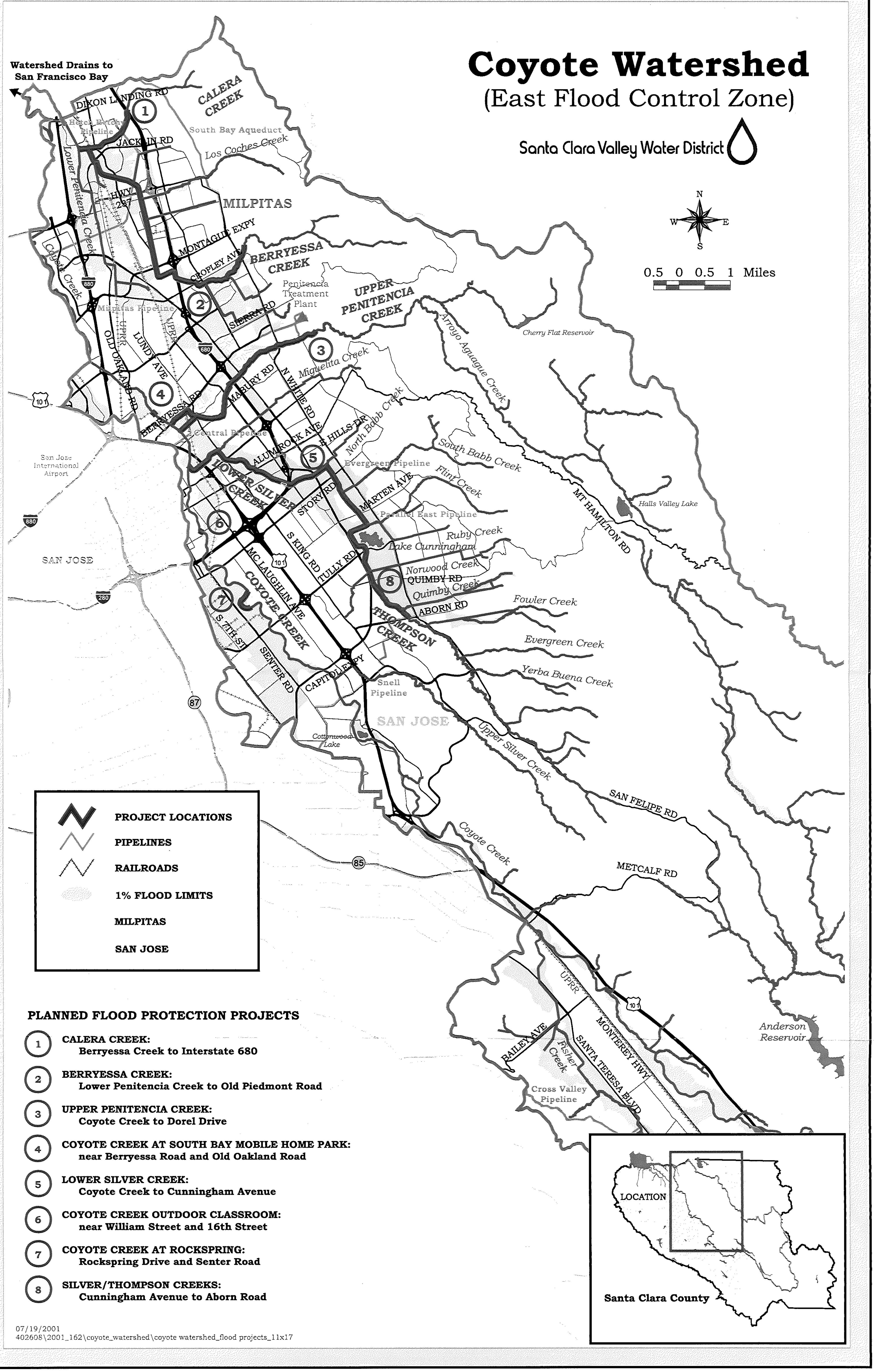
Coyote Watershed

(East Flood Control Zone)

Santa Clara Valley Water District



PLANNED FLOOD PROTECTION PROJECTS

① **CALERA CREEK:** Berryessa Creek to Interstate 680

② **BERRYESSA CREEK:** Lower Penitencia Creek to Old Piedmont Road

③ **UPPER PENITENCIA CREEK:** Coyote Creek to Dorel Drive

④ **COYOTE CREEK AT SOUTH BAY MOBILE HOME PARK:** near Berryessa Road and Old Oakland Road

⑤ **LOWER SILVER CREEK:** Coyote Creek to Cunningham Avenue

⑥ **COYOTE CREEK OUTDOOR CLASSROOM:** near William Street and 16th Street

⑦ **COYOTE CREEK AT ROCKSPRING:** Rockspring Drive and Senter Road

⑧ **SILVER/THOMPSON CREEKS:** Cunningham Avenue to Aborn Road

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SANTA CLARA VALLEY WATER DISTRICT UPPER PENITENCIA CREEK BYPASS PROJECT

TECHNICAL MEMORANDUM 2.0 HYDRAULIC ANALYSIS SUPPLEMENT

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REVIEWED BY: JOHN PLUMP JR., P.E.

AUGUST 2001

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Table of Contents

Table of Contents

INTRODUCTION **5**
Project Purpose and Scope 5
Project Description 6
Background 6

1.0 UPDATED HYDROLOGIC ANALYSIS FOR THE DESIGN FLOWS **8**
Recorded Stream Data 8
USGS Data 8
Watershed Model 10
Precipitation 10
Watershed Subbasin Characteristics 10

2.0 HYDRAULIC MODEL OF COYOTE CREEK **14**
Model Criteria 14

3.0 UPC HYDRAULIC MODEL **20**
Review of Existing Conditions Described from HATM 20
Model Criteria of Additional Analysis of Existing Conditions 20
Pre-Project Versus Post Project Conditions 21
Effect of the Existing King Road Bridge to Future Conditions 24

4.0 HEC-RAS MODEL OF THE PROPOSED BYPASS INCLUDING A DIVERSION FEATURE FROM UPC **26**
Proposed Bypass Features 26
Bypass Model Results 27
Bypass Outlet 28
Diversion Feature from UPC 28
Flow considerations for the flow split structure 29
Steelhead Protection Measures 29
Flow Split Operation Conditions 29
Channel Capacity & Hydrologic Performance Duration 30

5.0 ALTERNATIVE PROJECT CONFIGURATIONS AND MODEL RUNS OF FLOOD FREQUENCIES **31**
Flow Split structure 31
Lateral Weir Flow Characteristics 32
In-Line Weir Characteristics 34
Sedimentation and Debris Concerns 35
Review of Initial Hydraulic Analysis TM Alternatives 38
Flow Split Alternatives 39
Transition Channel Between the Flow Split Structure and Bypass Channel 44
Bypass Channel Design Alternatives 45
The Bypass Outlet 45
Bypass Alternative 1: Vertical Drop Structure and Deflecting Wall 46

Alternative 2: Vertical Drop Structure, Widened Outlet, and Riprap Banks........................48
Alternative 3: Curving of the Bypass Alignment 49
Alternatives Considered For Presentation of Model Runs and three flood frequencies............49
Flows Evaluated For the Bypass...49

6.0 PRESENTATION OF MODEL AND ONE-PERCENT FLOOD PROFILE OF FINAL DESIGN CONFIGURATION. 61

RECOMMENDATIONS 65

REFERENCES 66

APPENDIX - HEC-RAS Outputs

List of Tables

Table 1.1	24-hour Cumulative Precipitation for Upper and Lower Watershed
Table 1.2	Rainfall Loss Rates
Table 1.3	Baseflow Rates
Table 1.4	Baseflow Discharge
Table 1.5	Baseflow Parameters
Table 1.6	Muskingham Routing Parameters
Table 1.7	Future Conditions Hydrologic Results
Table 2.1	Peak Design Flow Discharges at Coyote Creek
Table 2.2	Hydraulic Properties for Coyote Creek at Proposed Bypass Outlet
Table 2.3	Hydraulic Properties for Coyote Creek at Proposed Bypass Outlet
Table 2.4	Time of Discharge Peak at Coyote Creek
Table 2.5	Peak Discharge and Timing Between Coyote Creek and UPC
Table 3.1	Channel Capacity with Various Manning's n Values
Table 3.2	Pre-Project Peak Frequency Discharges from UPC into Coyote Creek
Table 3.3	Maximum Flow at the King Road Bridge without Pressure Flow
Table 4.1	Hydraulic Performance of the Single Box and Double Box for the 100-year Event
Table 4.2	Flow Split Quantities for Capacity and 100-year Event
Table 4.3	Split Flow Discharge Durations for the 100-year Event
Table 5.1(a)	Pacific Southwest Interagency Committee Method (PSIAC)
Table 5.1(b)	Modified Universal Soil Loss Equation (MUSLE)
Table 5.2	Reach Average Sediment Transport Capacity
Table 5.3	Split Flow Quantities
Table 5.4	End of Bypass Velocity (fps) Decrease Due to Drop Structure
Table 5.5	Evaluated Flows Including the Design Flow and Other Significant Flows
Table 5.6	Bypass Evaluated Flows Including the Design Flow and Other Significant Flows
Table 5.7	Velocity Changes Throughout Drop Structure with Rip-Rap

List of Figures

Figure 1 Vicinity Map
Figure 1.1 Monthly Average Flows Water Year 1962 through 1987
Figure 1.2 USGS Recorded Annual Average Streamflow
Figure 1.3 Exceedance Discharge Probability Curve, USACE, 2001
Figure 2.1(a) Water Surface Profile for Coyote Creek Upper End Manning's n: Channel n=0.057 and Overbank n=0.114
Figure 2.1(b) Cross Section for Coyote Creek Upper End Manning's n: Channel n=0.057 and Overbank n=0.114
Figure 2.2 Hydraulic Properties for Coyote Creek at Proposed Bypass Outlet
Figure 2.3(a) Water Surface Profile for Coyote Creek, Channel n=0.036 and Overbank n=0.040
Figure 2.3(b) Cross Section for Coyote Creek, Channel n=0.036 and Overbank n=0.040
Figure 3.1 100-Year Floodplain Map
Figure 3.2 Flooding from UPC at Berryessa Road, 02/03/98
Figure 3.3 Existing Condition Performance Hydrograph
Figure 3.4 Future Post-Project Performance Hydrograph
Figure 4.1 Bypass Design Options
Figure 5.1(a) Side Weir Flow Schematic: Water Surface Profile of a Subcritical Flow Split
Figure 5.1(b) Side Weir Flow Schematic: Plan View
Figure 5.2 Efficiency of the lateral weir diversion with respect to changes in the discharge coefficient, C.
Figure 5.3 Bypass Outlet Drop Structure Water Surface Profile
Figure 5.4 Bypass Outlet Velocity Profile
Figure 5.5 UPC Water Surface Profile from Stand-Alone Later Weir
Figure 5.6 UPC Water Surface Profile for Stand-Alone Lateral Weir Close-Up
Figure 5.7 UPC Water Surface Profile for Stand-Alone Lateral Weir
Figure 5.8 Notched In-Line Weir, Hydraulic Control Structure
Figure 5.9 UPC Water Surface Profile from Lateral Weir with Notch
Figure 5.10 UPC Velocity Profile from Lateral Weir with Notch
Figure 5.11 UPC Water Surface Profile for Single Box Culvert
Figure 5.12 UPC Velocity Profile for Single Box Culvert
Figure 5.13 UPC Water Surface Profile for Double Box Culvert
Figure 5.14 UPC Velocity Profile for Double Box Culvert
Figure 5.15 Bypass Outlet Drop Structure Water Surface Profile
Figure 5.16 Bypass Outlet Velocity Structure
Figure 5.17 Bypass Outlet Drop Structure Water Surface Profile with Rip-Rap Outlet
Figure 5.18 UPC Velocity Profile for Widen Outlet and Increased Rip-Rap
Figure 6.1 Water Surface Elevations for Stand-Alone Weir for Flow Split

Figure 6.2 Velocities for Stand-Alone Weir for Flow Split
Figure 6.3 Water Surface Elevation for Single Culvert Bypass Channel
Figure 6.4 Velocities for Single Culvert Bypass Channel
Figure 6.5 Water Surface Elevation for Single Culvert Bypass Channel
Figure 6.6 Velocities for Drop Structure

Introduction

INTRODUCTION

This technical memorandum (TM) is a supplement to the Hydraulic Analysis Technical Memorandum (HATM) prepared by HDR Engineering, Inc., dated June 15, 2001. The TM discussed the Upper Penitencia Creek (UPC) flood control bypass project. Topics discussed in the previous TM have been summarized here, when necessary, for continuity, but other references will have to be made directly from the HATM. Specific topics to this TM include:

1. Review of Updated Hydrology for the Design Flows
2. Hydraulic Model of Coyote Creek with Design Flows
3. New UPC HEC-RAS model to 500 ft upstream of the bypass diversion location
4. HEC-RAS model of the proposed bypass including a diversion feature from UPC
5. Three alternative project configurations and model runs of 3 flood frequencies.
6. Presentation of model and one-percent flood profile of final design configuration.

Following the Santa Clara Valley Water District's (SCVWD) review of the previous TM, additional information is provided here reflecting new recommendations for specific features of the bypass system, as requested by SCVWD. This supplement concludes with new recommendations for the design of the diversion feature and a modification to the outlet.

Project Purpose and Scope

The purpose of this project is to begin the construction of a plan to reduce flood damage to the developments in the Upper Penitencia Creek watershed, particularly the lower developed region of the watershed. The level of protection to be provided is up to the 1% or 100-year storm. In 1990, the National Resource Conservation Service (NRCS), formerly the Soil Conservation Service (SCS), conducted and produced a watershed plan. The plan partitioned the lower urbanized floodplain into eight reaches. The rural upper most watershed was left out of the plan. This supplement and the initial HATM addresses the flood protection of the design and construction of the first of the eight reaches, reach one in the plan. Reach one is bordered by the confluence with Coyote Creek to about 1,000 feet upstream of King Road, approximately 2,500 feet of channel.

Project Description

The reach project entails the construction of a flow split structure starting about 200 feet upstream of King Road, which will spill flows in excess of the natural channel's capacity into a proposed concrete bypass channel. The bypass channel will extend 2,500 feet southwest from the flow split structure to Coyote Creek. Split flows will drain into Coyote Creek approximately 1,200 feet upstream from the natural channel confluence.

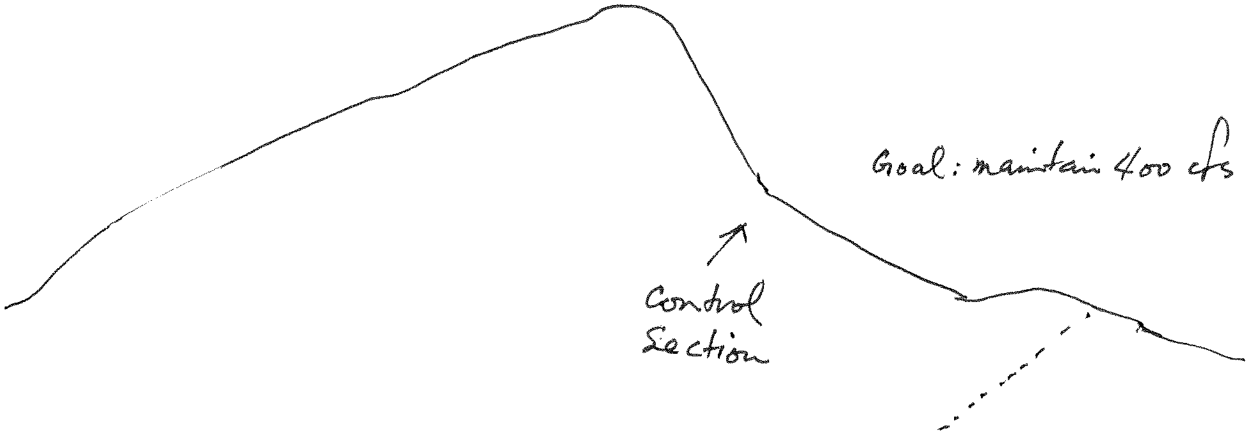
See Figure 1, attached vicinity and project map.

Background

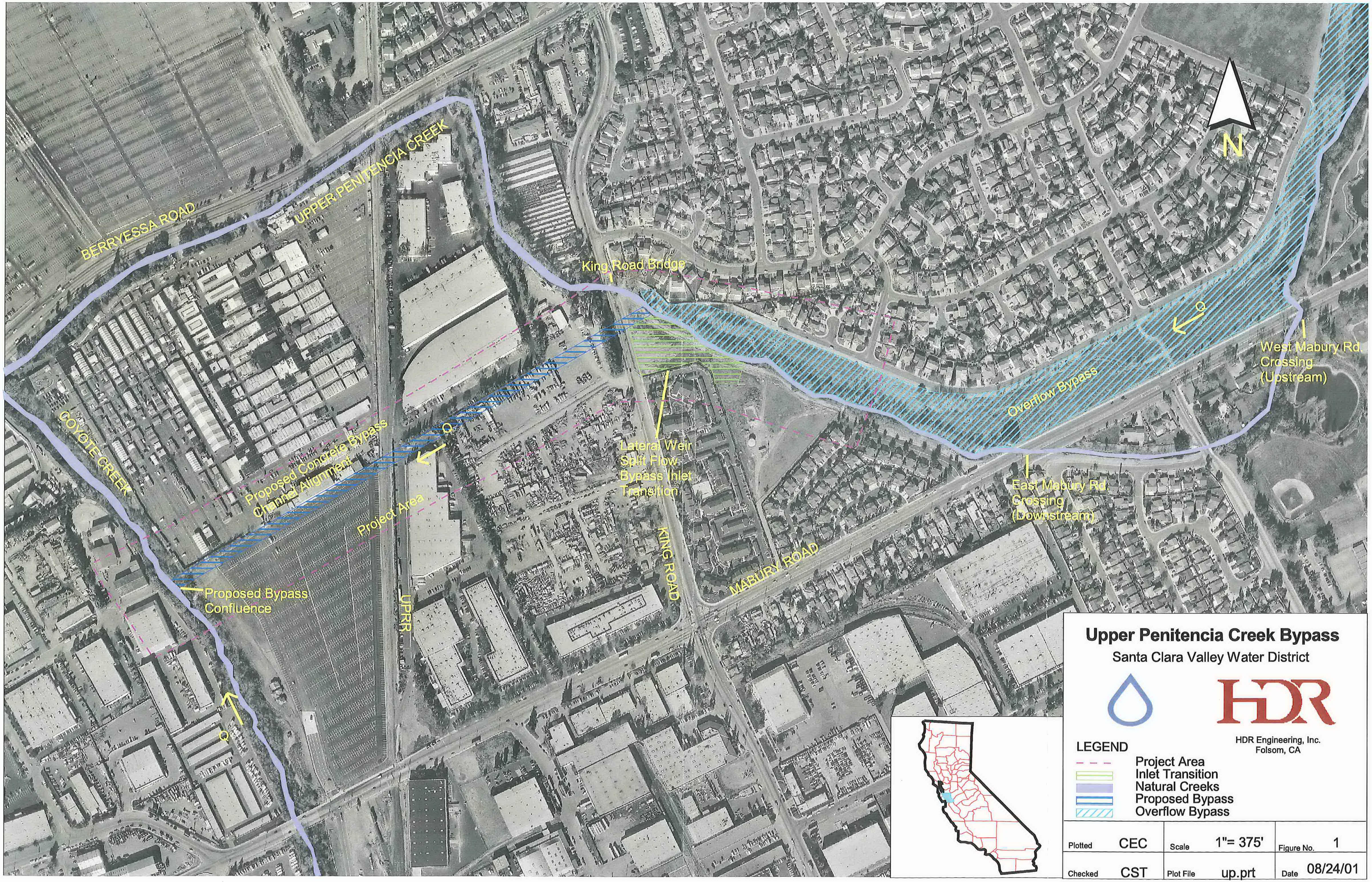
Located in San Jose, California, UPC is a subwatershed to the Coyote Creek Watershed and is managed by the Santa Clara Valley Water District (SCVWD), directly managed by the Coyote Creek Watershed Program. The watershed is approximately 24 square miles with headwaters at Poverty Ridge in the mountains east of the city of San Jose and terminating at Coyote Creek, an elevation change from approximately 3,100 feet elevation down to 65 feet elevation at the confluence with Coyote Creek. The UPC watershed can be defined by two subbasins, the upper undeveloped subbasin and lower developed subbasin. The upper watershed is 21.5 square miles and is characterized as rugged terrain with steep slopes and is sparsely populated. The lower watershed is 2.5 square miles and starts around Dorel Drive at 250 feet elevation. This region is heavily populated and well developed. The land use transitioned from agriculture to urban uses, most of it occurring in the last 30 years.

The climate can be defined as Mediterranean with hot dry summers and cool winters. Temperatures range from the 100's (in ^{0}F) in the lower watershed during the summers down to the 20's in the winter in the upper watershed. Average rainfall is 14 inches in the lower watershed and 18 inches in the upper watershed. Stream flow in the upper watershed can be described as intermittent with streams drying up during the summer months. The lower creek typically has flow in it all year, although some years of data show completely dry conditions. SCVWD diverts water off the main stream to feed water into percolation ponds. There are three percolation ponds along UPC between Dorel Drive and Coyote Creek.

Existing : 2000 cfs
future : 4770 cfs allowing 600 cfs in natural channel



Goal : maintain 400 cfs



N
BERRYESSA ROAD
UPPER PENITENCIA CREEK
King Road Bridge
Q
West Mabury Rd Crossing (Upstream)
Overflow Bypass
Lateral Weir Split Flow Bypass Inlet Transition
East Mabury Rd Crossing (Downstream)
COYOTE CREEK
Proposed Concrete Bypass Channel Alignment
Q
Project Area
KING ROAD
MABURY ROAD
Proposed Bypass Confluence
UPRR
Q

Upper Penitencia Creek Bypass

Santa Clara Valley Water District

HDR Engineering, Inc.
Folsom, CA

LEGEND

- Project Area
- 🟩 Inlet Transition
- Natural Creeks
- Proposed Bypass
- ▨ Overflow Bypass

Plotted	CEC	Scale	1"= 375'	Figure No.	1
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1.0 Review of Updated Hydrology for Design Flows

1.0 UPDATED HYDROLOGIC ANALYSIS FOR THE DESIGN FLOWS

RECORDED STREAM DATA

The following recorded stream data was collected from the SCVWD and the United States Geologic Survey (USGS) website. The stream gage at Dorel Drive was managed by USGS from water year 1943 to 1992. From 10/1/87, SCVWD has assumed management of the data. Low flow data less than 300 cfs after 1992 is not assumed to be entirely accurate. From that year, Fish and Game Regulations had set limits to sediment removal practices in the stream, thus the water district was not allowed to remove sediment that would interfere with accurate flow readings less than 300 cfs. Higher flow events are still assumed to be as accurate as pre-1992 recordings. A second gage was located at Piedmont Road, downstream of the Dorel Road Station. The data was obtained from SCVWD. See Figure 1.1 and 1.2 for monthly and average annual streamflow.

USGS Data

Gage Reference Information:

Duration of Data: Water Year 1961 to 1987

Santa Clara County, California

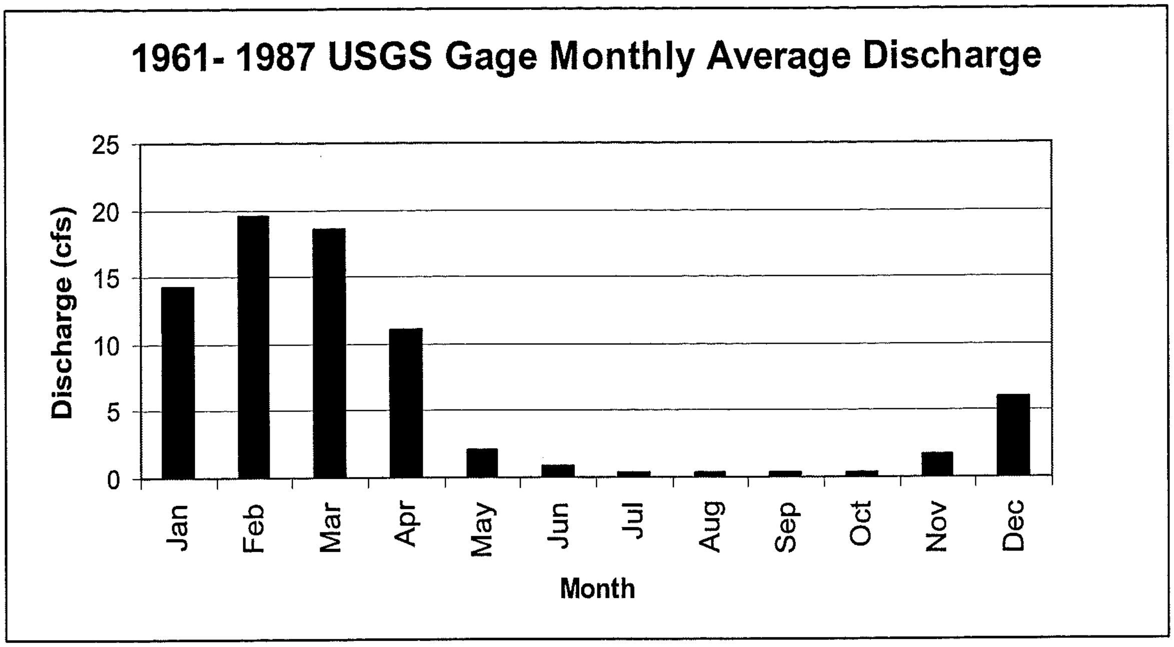
Hydrologic Unit Code 18050003

Latitude 37°23'43", Longitude 121°49'38" NAD27 (Dorel Drive)

Drainage area 21.50 square miles

Gage datum 265.30 feet above sea level NGVD29

Daily average flow: 6.25 cfs



* Missing Data for Water Year 1948, and 1962-1965

Figure 1.1: Monthly Average Flows Water Year 1962 to 1987

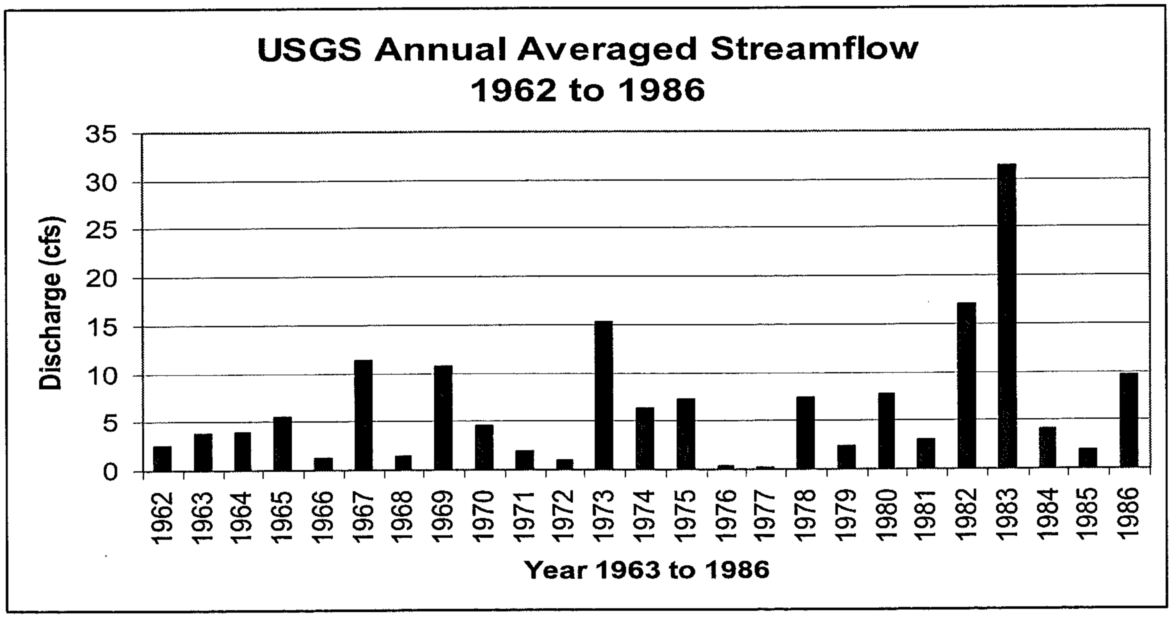


Figure 1.2: USGS Recorded Annual Average Streamflow at Dorel Drive

WATERSHED MODEL

The UPC watershed was modeled utilizing the Army Corps of Engineers (COE) HEC-Hydrologic Modeling System software version 2.0. The model determined the precipitation-runoff relationship of the watershed for the existing and proposed conditions. See Table 1.1. The input files and boundary conditions were obtained from COE, San Francisco District (COESF). The model was used to determine the runoff characteristics and timing of flows for the 2-yr, 10-yr, 50-yr, 100-yr, and 500-yr events for both existing and future conditions. Coefficients were obtained from the report by COESF, dated January 2001, "UPC Hydrologic Engineering Office Report." The runoff hydrographs were used to determine performance hydrographs of the flow split structure in which duration and magnitude of the flow split structure were obtained.

Precipitation

Precipitation data was obtained from COESFD, which consisted of the 24-hour rainfall event. The model was based on data collected at the Lick Observatory on Mt. Hamilton. The lower subbasin precipitation data was collected at the National Weather Service Station in San Jose. The rainfall data was then statistically analyzed to reflect each respective exceedence probability event.

Table 1.1: 24-Hour Cumulative Precipitation for Upper and Lower Watershed Subbasin

	10-Yr	50-Yr	100-Yr	500-Yr
Upper Watershed	3.11 inches	4.20 inches	4.64 inches	5.75 inches
Lower Watershed	2.77 inches	3.74 inches	4.12 inches	5.13 inches

Watershed Subbasin Characteristics

The 24 square miles of UPC watershed was broken into two subbasins, the upper watershed and lower watershed. The upper watershed is 21.5 square miles of rural, undeveloped land with mountainous terrain. The elevation ranges from 3,300 feet elevation at Poverty Ridge down to 50 feet elevation at the confluence with Coyote Creek. The average annual precipitation at Poverty Ridge is 14 inches. There are two major drainage reaches in the upper watershed, UPC and Arroyo Auguague, with the latter being the major drainage arm. The topography is steep and rugged. The upper and lower watershed is separated around Dorel Drive. The lower watershed is 3.5 square miles, well developed and relatively flat when compared to the upper watershed. The lower boundary is the confluence with Coyote Creek. Subbasin hydrologic characteristics were obtained from the Hydrologic Office Report, which are summarized in the following Tables 1.2 through 1.6.

Future 20% impervious
Stream data
6.25 cfs

Table 1.2: Rainfall Loss Rates

	10-Yr	50-Yr	100-Yr	500-Yr
Initial Loss	0.25 inches	0.20 inches	0.18 inches	0.16 inches
Constant Loss	0.15 in/hr	0.10 in/hr	0.08 in/hr	0.06 in/hr

Table 1.3: Baseflow Rates

	10-Yr	50-Yr	100-Yr	500-Yr
Base Flow	4 cfs/sq mi	5 cfs/sq mi	6 cfs/sq mi	9 cfs/sq mi

Table 1.4: Baseflow Discharge

	10-Yr	50-Yr	100-Yr	500-Yr
Initial Discharge	4 cfs/sq. mi.	5 cfs/sq. mi.	6 cfs/sq. mi.	9 cfs/sq. mi.

Table 1.5: Baseflow Parameters

Baseflow Method	Recession Constant	Threshold Discharge Constant	Threshold Unit Method
Recession	1	0.01	Ratio:Peak

Table 1.6: Muskingham Routing Parameters

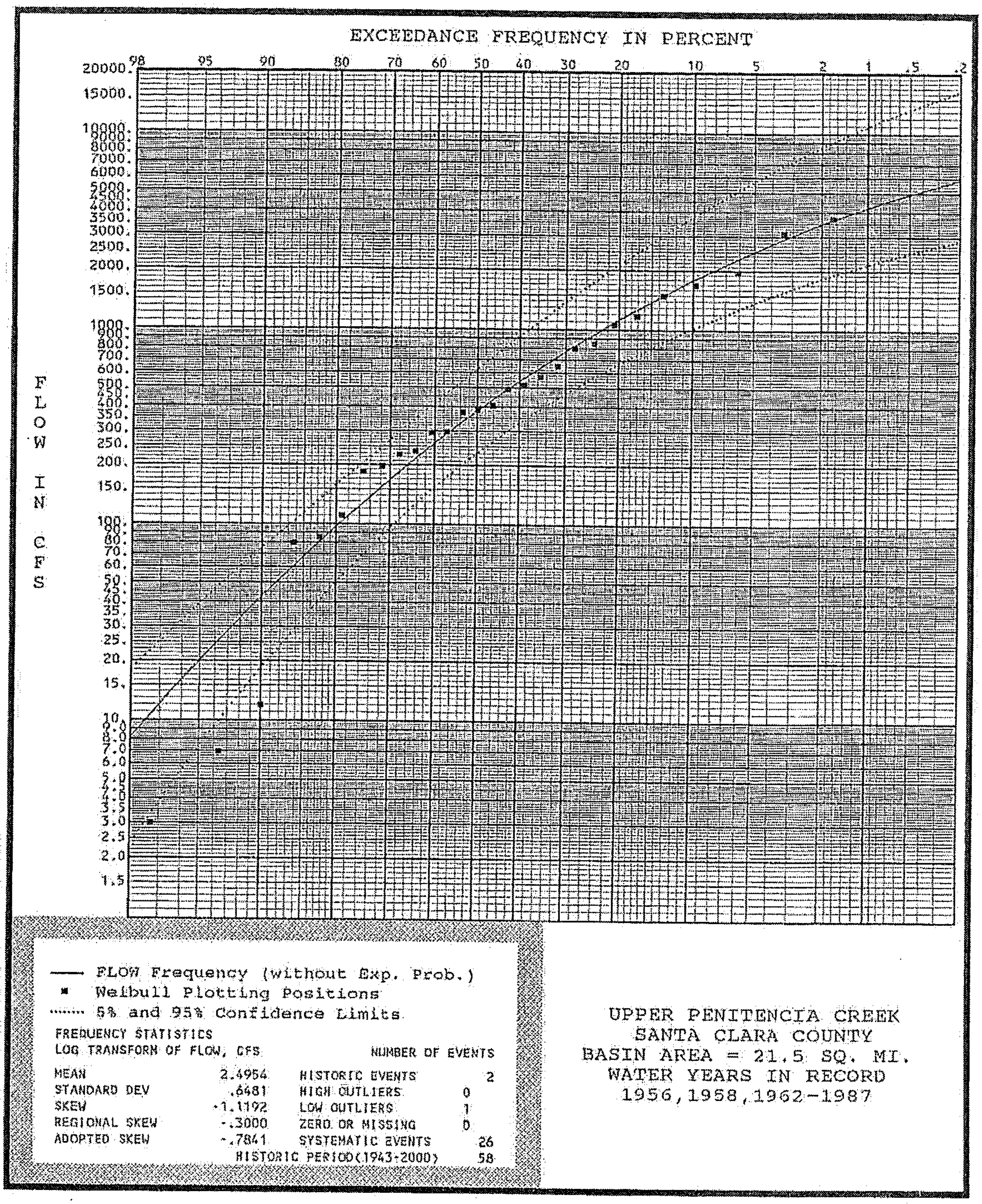
	Project Conditions	Post-Project Conditions
Travel Time, K	0.56 hours	0.49 hours
Routing coefficient, X	0.20	0.40
Computation Interval	30 minutes	15 minutes
Number of Routing Steps	1	2

The following results reflect those that were reported in the COE, San Francisco Hydrologic Office Report. The runoff totals are slightly higher for the 100-year event at 4,990 cfs, 250 cfs more than the design storm. However, the purpose of the analysis conducted here were to obtain a runoff hydrographs for particular events and understand the duration of operation of the proposed project. See Table 1.7 for runoff magnitudes. Duration times will be discussed in section 4 and shown in Table 4.3.

Table 1.7: Future Conditions Hydrologic Results

Event	10-Year	50-Year	100-Year	500-Year
Peak Runoff From Watershed Above Dorel Drive	1,980 cfs 2270 cfs	3,910 cfs 3850 cfs	4,600 cfs 4550 cfs	6,100 cfs 6010 cfs
Peak Runoff From Watershed Below Dorel Drive	580 cfs	880 cfs	1,070 cfs	1,390 cfs
Combined Peak Watershed Discharge	2,110 cfs	4,210 cfs	4,990 cfs	6,650 cfs

Figure 1.3 was obtained from the COE UPC Hydrologic Office Report and shows the discharge-exceedance probability chart for UPC.



—— FLOW Frequency (without Exp. Prob.)
■ Weibull Plotting Positions
······· 5% and 95% Confidence Limits

FREQUENCY STATISTICS

LOG TRANSFORM OF FLOW, CFS		NUMBER OF EVENTS	
MEAN	2.4954	HISTORIC EVENTS	2
STANDARD DEV	.6481	HIGH OUTLIERS	0
SKEW	-1.1192	LOW OUTLIERS	1
REGIONAL SKEW	-.3000	ZERO OR MISSING	0
ADOPTED SKEW	-.7841	SYSTEMATIC EVENTS	26
		HISTORIC PERIOD(1943-2000)	58

UPPER PENITENCIA CREEK
SANTA CLARA COUNTY
BASIN AREA = 21.5 SQ. MI.
WATER YEARS IN RECORD
1956,1958,1962-1987

EXHIBIT J (CONTD)

Figure 1.3: Exceedence Discharge Probability Curve, USACE, 2001

2.0 Hydraulic Model of Coyote Creek

2.0 HYDRAULIC MODEL OF COYOTE CREEK

The Coyote Creek hydraulic conditions were modeled in the vicinity of the bypass outlet. In order to determine the best design for the bypass outlet, it was necessary to determine the downstream flow conditions of the bypass channel, which would be Coyote Creek. The bypass outlet had to be designed to that Coyote Creek would not impede proper drainage of the proposed bypass channel. The downstream flow conditions components to be understood are the water surface elevations and flow velocities. It was assumed that pre and post project conditions in Coyote Creek will not change. However, this assumption may not be entirely accurate because as more flood protection is provided to more subwatersheds to the Coyote Creek watershed, the creek channel itself will likely change due to the changes to flow frequency and magnitude. The extent of these changes is not known.

Model Criteria

The Army Corps of Engineers (COE) HEC-River Analysis System (RAS) software version 3.0 was utilized to create water surface profiles and velocities. Cross sections were obtained from AutoCAD topographical maps provided to HDR by SCVWD. The flow frequency magnitude, channel invert, and downstream water surface boundary conditions were obtained from the 1986 Santa Clara County Flood Insurance Study (FIS) conducted by the Federal Emergency Management Agency.

The FIS did not list the event-discharge relationship at the confluence of UPC and Coyote Creek. The closest listing was Coyote Creek at Silver Creek, approximately 5,000 feet upstream of the confluence of UPC at Coyote Creek. No other major drainages exist between the Silver Creek and UPC confluences. It is assumed that these flow conditions are accurate at the confluence with the proposed bypass.

Table 2.1: Peak Design Flow Discharges at Coyote Creek

Event	Coyote Creek Confluence with Silver Creek	Bypass Channel @ Confluence with Coyote Creek	Upper Penitencia Creek @ Confluence with Coyote Creek
10-Year	6,200 cfs	2,070 cfs	250 cfs
50-Year	10,300 cfs	3,530 cfs	490 cfs
100-Year	12,500 cfs	4,140 cfs	600 cfs
500-Year	15,000 cfs	5,360 cfs	930 cfs

The segment of Coyote Creek that was modeled included 300 feet upstream and 450 feet downstream of the proposed bypass outlet, at 50-foot cross-sectional increments. In the 750-foot river segment evaluated, the left and right banks vary in elevation, with the difference in elevation being between 6 to 11 feet. The model results reflect the hypothetical condition where vertical walls exist at the left and right extent of the overbank, thus flow that exceeds the main channel remains trapped over the overbanks by vertical walls. The Manning's n range used were 0.036 to 0.057 for the channel and 0.04 to 0.114 for the overbank. The two scenarios examined were the highest n values and lowest n values of the given range. For the results of the hydraulic properties at the cross section of the proposed bypass outlet, see Table 2.2, Figure 2.1a and Figure 2.1b for upper end Manning's results. See Table 2.3, Figure 2.3a, and Figure 2.3b for lower end Manning's results.

Table 2.2: Hydraulic Properties for Coyote Creek at Proposed Bypass Outlet
Upper End Manning's Range: Channel n = 0.057, Overbank n=0.114

Frequency	10-Year	50-Year	100-Year	500-Year
Discharge	6,200 cfs	10,300 cfs	12,500 cfs	15,000 cfs
Velocity	5.28 ft/s	6.54 ft/s	7.18 ft/s	7.82 ft/s
Water Surface Elevation	72.88 ft	76.66 ft	78.16 ft	79.71 ft
Depth*	16.98 ft	20.76 ft	22.26 ft	23.81 ft

* Invert elevation at 55.9 ft

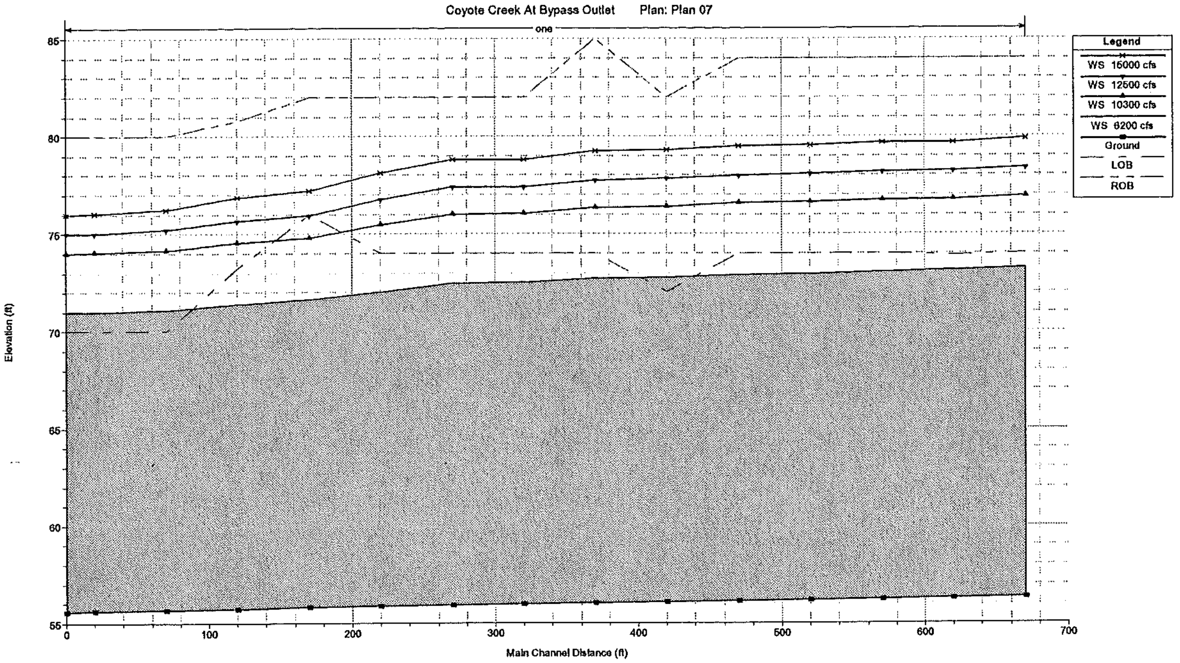


Figure 2.1a: Water Surface Profile for Coyote Creek Upper End Manning's n: Channel n=0.057 and Overbank n=0.114

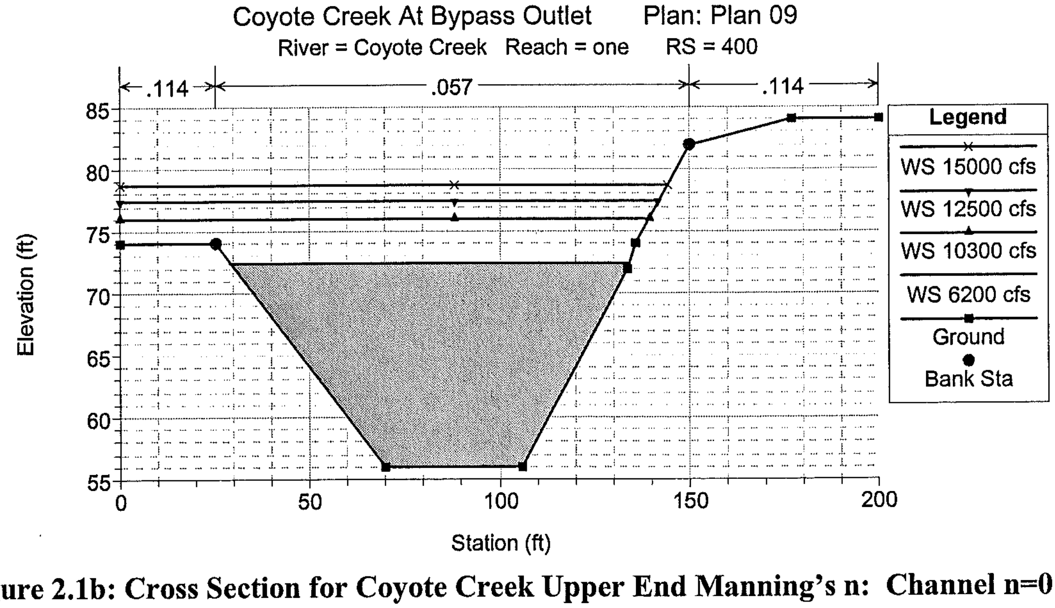


Figure 2.1b: Cross Section for Coyote Creek Upper End Manning's n: Channel n=0.057 and Overbank n=0.114

Table 2.3: Hydraulic Properties for Coyote Creek at Proposed Bypass Outlet
Lower End Manning's Range: Channel n = 0.036, Overbank n=0.040

Frequency	10-Year	50-Year	100-Year	500-Year
Discharge	6,200 cfs	10,300 cfs	12,500 cfs	15,000 cfs
Velocity	5.58 ft/s	6.94 ft/s	7.62 ft/s	8.33 ft/s
Water Surface Elevation	71.85 ft	75.22 ft	76.49 ft	77.73 ft
Depth*	15.95 ft	19.32 ft	20.59 ft	21.83 ft

* Invert elevation at 55.9 ft

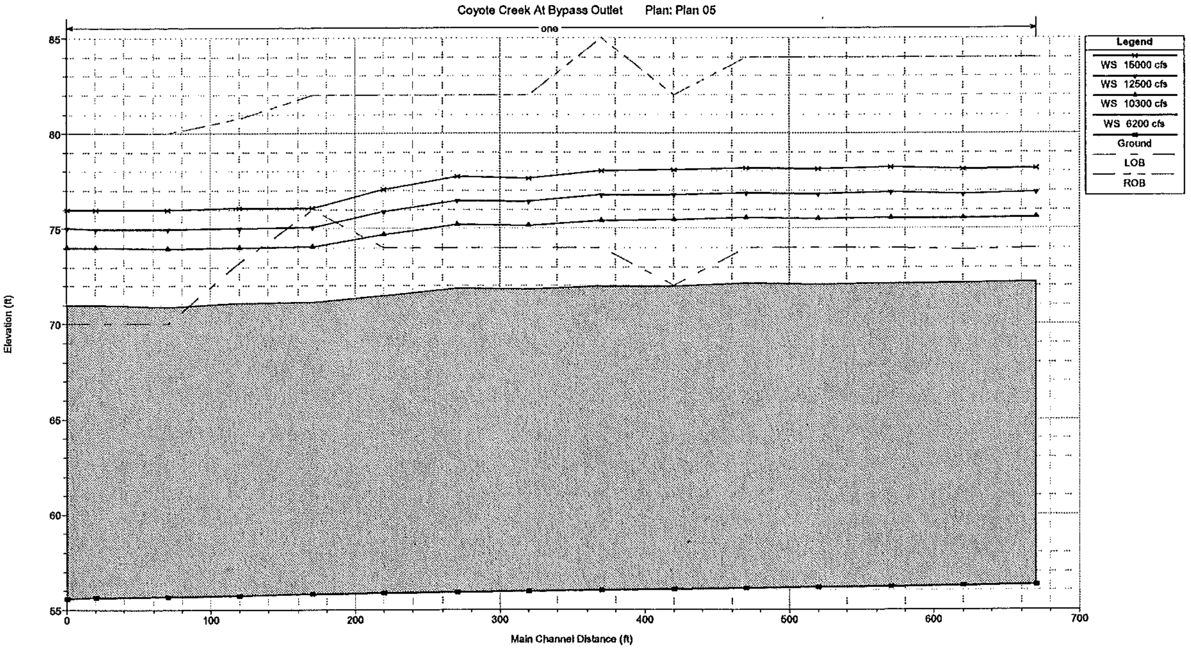


Figure 2.3a: Water Surface Profile for channel n=0.036 and Overbank n=0.040

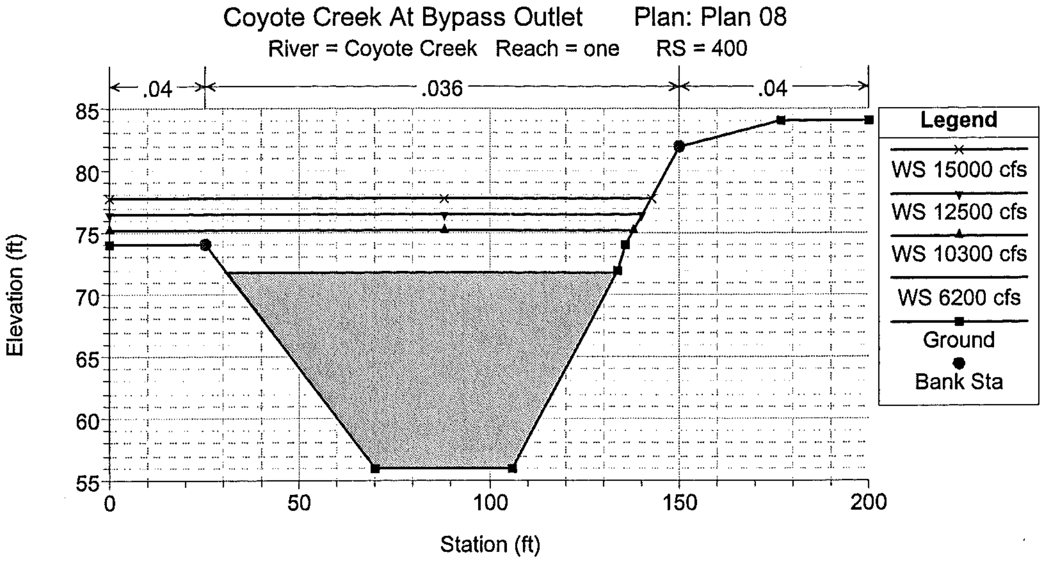


Figure 2.2b: Cross Section for Coyote Creek, Channel n=0.036 and Overbank n=0.040

Table 2.3: Time of Discharge Peak at Coyote Creek*	
Event	**Time to Peak**
10-Year	17.75 hrs
50-Year	17.75hrs
100-Year	17.75 hrs
500-Year	18.00 hrs

* 1990 Coyote Creek Runoff Hydrograph. See Appendix.

Model results show that flow over tops the left bank of Coyote Creek. (facing downstream) as early as the 10-Year event. Additional flows from the bypass channel and UPC would be flowing into a channel already at or above capacity. Flood protection should be provided to Coyote Creek to minimize adverse affects to properties adjacent to Coyote Creek. X

The timing of the peak discharge between UPC and Coyote Creek are not simultaneous. In the 1990 NRCS report, a runoff hydrograph of the 100-year event of Coyote Creek and UPC shows the following peak times. See Table 2.4 for runoff discharge and timing.

Table 2.4: 100-Year Peak Discharge and Timing Between Coyote Creek and UPC

	Existing Pre-Project Condition		Future Post-Project Condition	
	Peak Flow	Time to Peak	Peak Flow	Time to Peak
UPC	2,600 cfs	15 hours	4,400 cfs	4 hours
Coyote Creek	12,600 cfs	50 hours	14,400 cfs	50 hours
Combined Peak	6,200 cfs*	17 hours	7,500 cfs*	16 hours

* The combined peak is the highest flow experienced in Coyote Creek as a result from UPC's influence.

Under project conditions, UPC reaches it's peak flow at King Road for the 1% flood approximately 48 hours before Coyote Creek does (USACE, 1995), therefore, the diverted flows will not increase the peak 1% flood elevations in Coyote Creek. The timing of Coyote Creek's flow is such that when peak flows from UPC reach Coyote Creek, the flow is approximately the 30-year level of 72-feet elevation. The addition of UPC discharge to Coyote Creek would raise water surface elevation over the 50-year level. When the peak flows from Upper Penitencia Creek reach Coyote Creek, the flow in Coyote Creek is approximately the 30-year storm level or at elevation of 72 feet (Firth, 2001). At the bypass location, the top of the right bank of Coyote Creek is at elevation 83 feet, while the top of left bank is at elevation 76 feet, resulting in a 7-foot elevation difference between the left bank and right bank. When the bypass is flowing at design capacity, Coyote Creek water surface is at elevation 72 feet.

Model results indicate the influence of the bypass at the design flow capacity raises the water surface in Coyote Creek to bankfull without freeboard. In both the upper and lower Manning's values, the difference between the 10-year and 50-year is 4,110~~0~~ cfs, which is the approximately the magnitude of discharge from the proposed bypass.

Without the bypass channel, Coyote Creek would experience this flow 1,200 feet downstream, at the natural confluence. The cross section conditions there were not investigated.

3.0 UPC Hydraulic Model

3.0 UPC HYDRAULIC MODEL

REVIEW OF EXISTING CONDITIONS DESCRIBED FROM HATM

The existing channel capacity, as reported in the COESF January 2001 report, was re-evaluated utilizing the HEC RAS files received from USACE. Based upon this re-evaluation, the capacity was found to be less than what was initially reported.

The channel conditions in the model show generally incised channels. Roughness coefficients were obtained from the report as 0.05 for the main channel and 0.04 for the overbank conditions. The majority of the existing channel is incised with a few cross sections showing non-engineered levees or berms built up on the banks. These built up banks were not considered to be acceptable barriers to flooding. Thus, they were not considered when determining the existing channel capacity.

One criterion for determining the maximum UPC channel capacity was insuring freeboard requirements of the Santa Clara Valley Water District (SCVWD), the Federal Emergency Management Agency (FEMA), and USACE were met. SCVWD standards require at least 3.5 feet of freeboard for leveed sections, 4 feet within 100 feet of bridges or other constrictions, or two-tenths of the specific energy, whichever is greater. For water surfaces below the natural ground, freeboard allowance shall be 1-foot or two-tenths of the total energy. FEMA has a ½-foot less condition for leveed sections and the same requirement for bridges and other constrictions. USACE generally designs for a 90% reliability result for a Risk and Uncertainty (R&U) analysis in determining channel capacity. This means that there is 90% confidence that the flow will not cause flooding. The channel was evaluated as an incised channel. For sections that had built up banks, the top of bank was estimated by extrapolating the elevation of the existing ground outside of the berm, drawing an imaginary line through the berm, to the intersecting elevation of the channel bank. The bridge piers and decks were made wider and the channel "n" value was increased to 0.05 to simulate floating debris, as is commonly found during flood stages.

Model Criteria of Additional Analysis of Existing Conditions

The HEC-RAS model was used to model the existing and proposed conditions of UPC for the flow split system. The existing conditions were modified to characterize the proposed changes to the design reach topography. The flow events modeled were as follows: 2-year, maximum downstream channel capacity, 10-year, 25-year, 50-year, 100-year, and 500-year flow events.

A sensitivity analysis was carried out for the Manning's roughness coefficients, "n", for the existing conditions, interim project performance, and buildout projection. Manning's values range from 0.03 to 0.70 for in-stream conditions and 0.40 to 0.80 for overbank conditions. Most stream conditions warrant higher Manning's values for the overbank than in the natural channel. However, in the case for UPC, the overbank areas have been partially or fully developed. Many of the overbanks border sidewalks or parks with pavement or grass. The trees exist mainly along the slopes of the banks between the top of banks and the channel proper, which the roughness has been accounted for in the in-channel roughness coefficient. Most of the channel is incised with only a few built up levees.

Table 3.1: Channel Capacity With Various Manning's n Values

Manning's n		**Flow Property**		
In – Channel	**Overbank**	**Discharge Capacity**	**Velocity at King Road With Bridge**	**Velocity at King Road Without Bridge**
0.03	0.02	875	5.93	6.15
0.04	0.03	850	5.04	5.45
0.05	0.04	600	4.11	4.31
0.06	0.05	500	3.49	3.65
0.07	0.06	450	3.05	3.21

The model results were evaluated by COESF Hydraulics and Hydrology section and an R&U analysis was conducted. With a Manning's n=0.05 for in-channel and 0.04 for overbank, the maximum capacity of the existing channel below King Road was determined to be 600 cfs with 95% confidence and an average flow velocity of 4.9 ft/s along the proposed flow split location. The 600 cfs corresponds to the 2.8-year event. See the HATM appendix for HEC-RAS results and cross sections from this analysis. The 600cfs capacity is due to a channel constriction approximately 450ft downstream of King Road. Beyond that location, the channel capacity increases to at least 750cfs. See Table 3.1 for model results for various Manning's values.

Pre-Project Versus Post Project Conditions

In the existing condition, upstream reach of UPC does not have the capacity to deliver the 100-year design flow to 4,740 cfs to the King Road project site. A recent study by COESF on the channel and overbank shows 2,000 cfs reaches the upstream Mabury Road crossing. 2,000 cfs corresponds to the 8% or 12.5-year event.

Under existing conditions, most of the flow is lost at highway 680 approximately 1 mile upstream of King Road. The majority of the lost flow leaves the UPC floodplain and eventually drains into Coyote Creek to the north, while a portion of the flow that breechs the channel flows down Berryessa Road parallel to UPC. Approximately 2,000 cfs flows past highway 680, distributed between the natural channel and the bypass. This is distributed between the natural channel and existing bypass channels, through Jackson Avenue Bridge and the two Mabury Road crossings.

See Figure 3.1 for 100-year floodplain map

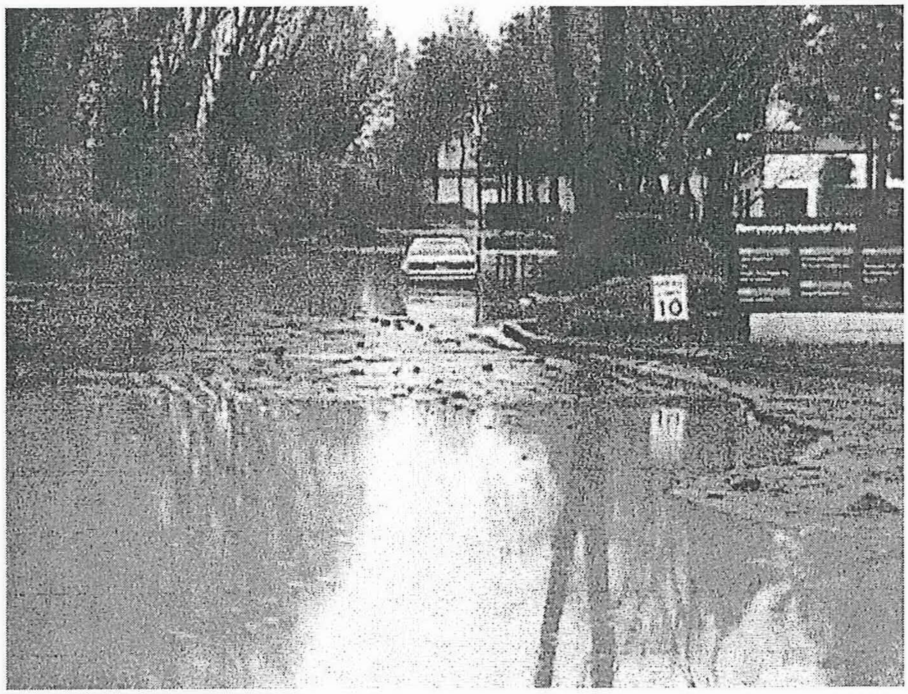


Figure 3.2: Flooding from UPC at Berryessa Road, 2-3-98 (Coursety of SCVWD O&M)

400 cfs passes through the upstream Mabury Road crossing while the remaining 1,600 cfs is diverted into the bypass. At the second Mabury Road channel crossing, the low flow channel re-joins the bypass channel flow. It is also there that flow is breeched along the southwest bank between the Mabury Road and the King Road Bridge and flows overland into Coyote Creek. It is also at King Road that the flow that breeched the channel at highway 680 re-joins flows that have breeched the channel at King Road and flows overland into Coyote Creek along the Berryessa Road corridor. Of the 2,740 cfs that is lost from UPC at highway 680, the magnitude of flow that flows overland down the Berryessa Road corridor is not known. See table 3.1 for flow distribution.

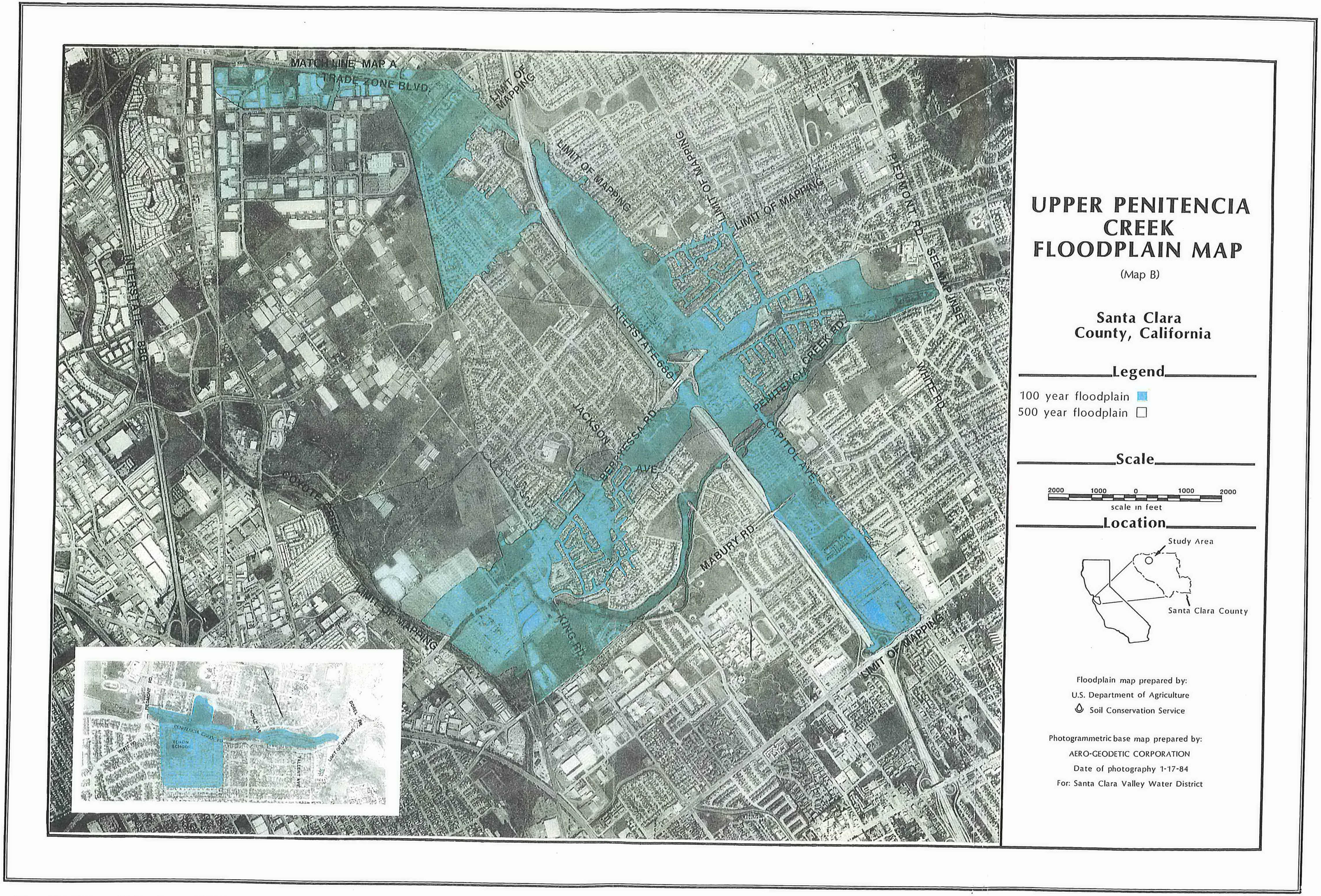


Figure 3.1: 100- year Project Area and Vicinity Flood Plain Map (SCS, 1990)

Table 3.2: Pre-Project Peak Frequency Discharges from UPC into Coyote Creek

Event	Theoretical Flow Magnitude At King Road	Flow Lost to the Floodplain	Existing Condition Flow Delivered to King Road	Flow Capacity Downstream of King Road
10-Year	2,320 cfs	3,580 cfs	1,700 cfs	600 cfs
50-Year	4,020 cfs	2,020 cfs	2,000 cfs	600 cfs
100-Year	4,740 cfs	2,740 cfs	2,000 cfs	600 cfs
500-Year	6,260 cfs	4,260 cfs	2,000 cfs	600 cfs

The following Figures, 3.3 and 3.4, illustrate the ruoff hydrographs for UPC. Three conditions have been presented, the existing, the interim project, and future project. The existing conditions refers to conditions as is today. The interim project refers to the current proposed project that this TM address. The future project reflects conditions after the entire lower UPC watershed has been provided with 100-year flood protection. After the lower UPC watershed has been provided with 100-year flood protection then the project will experience the entire 4,740 cfs. In the interim, 2,000 cfs will reach the project site with 2,740 cfs being lost to flooding overland. The project will be designed to provide protection for the future conditions of 4,740 cfs and the interim condition of 2,000 cfs.

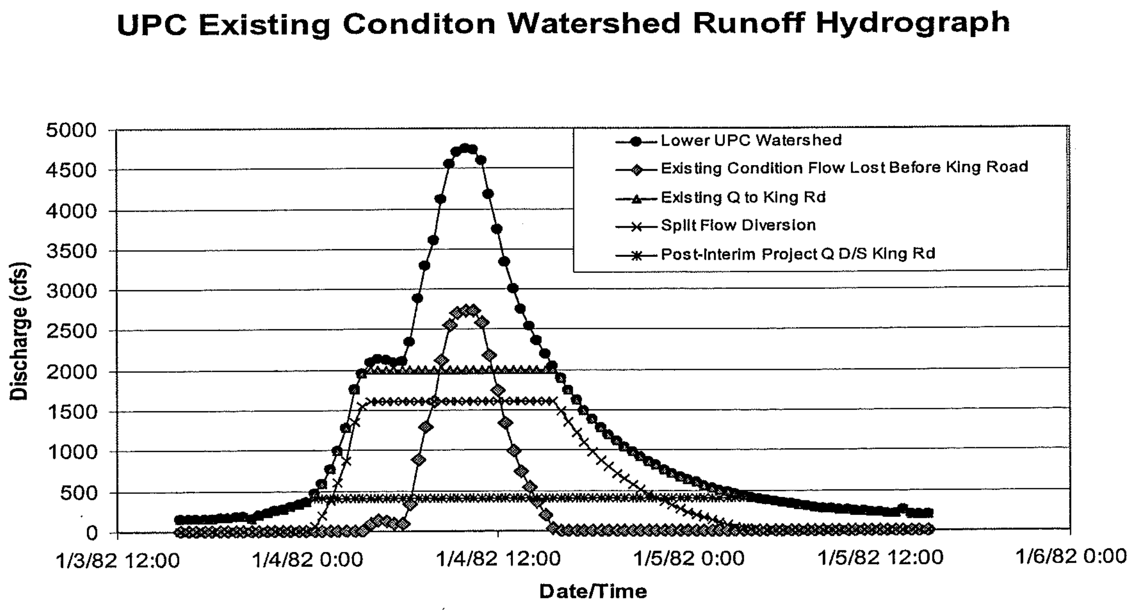


Figure 3.3: Existing Condition Performance Hydrograph

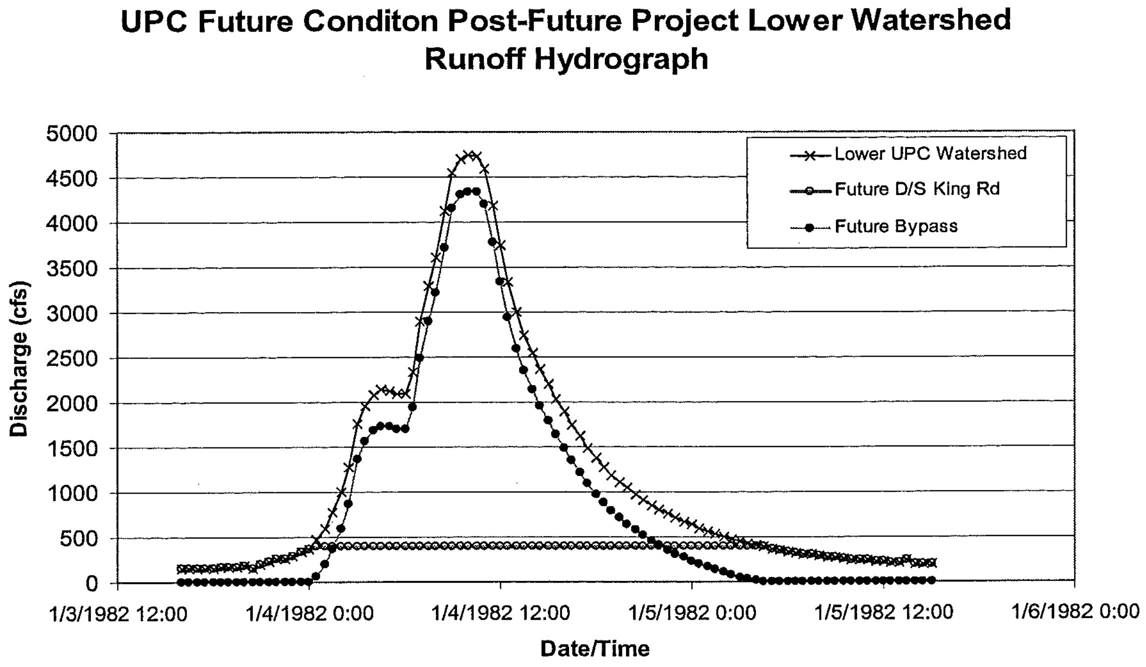


Figure 3.4: Future Post-Project Performance Hydrograph

Effect of the Existing King Road Bridge to Future Conditions

The King Road Bridge is planned to be reconstructed. The following analysis was to determine if modeling with the King Road Bridge absent would change the flow characteristics in the vicinity of the bridge. Should the King Road Bridge be re-designed to remain completely out of the channel, it could change the flow characteristics previously modeled.

The future performance of a flood control structure should reflect conditions where a newly designed bridge would not influence the performance of the proposed flow split structure nor cause drastic changes to the existing flow characteristics of the channel. Flow would be affected when the water surface exceeds the low chord or lowest elevation of the bridge. This condition is known as pressure flow. Table 3.3 shows the results of the various flow conditions at King Road under various Manning's values. The existing King Road Bridge has a low chord of 89.2 feet elevation. An analysis was conducted to investigate the relationship between the low chord of the bridge and the point in which pressure flow occurs under various Manning's values.

Table 3.3: Maximum Flow at The King Road Bridge Without Pressure Flow*

Manning's n: In-Channel / Overbank	Maximum Flow	Velocity
0.30/0.02	725 cfs	5.81
0.40/0.03	600 cfs	4.83
0.50/0.04	525 cfs	4.04
0.60/0.05	450 cfs	3.46
0.70/0.06	375 cfs	3.02

*Low chord elevation of the King Road Bridge is 89.2ft elevation.

It was found that a 0.01 incrase in n resulted in approximately 75 cfs decrease in flow capacity before pressure flow under King Road occurred. For the recommended n=0.05 Manning's condition, which was used to determine the maximum channel capacity of 600 cfs, the water surface elevation at the upstream face of the King Road Bridge was 89.87 feet. Without the bridge, the water surface elevation would be 0.2 ft higher

Model results reveal that the existing King Road Bridge begins pressure flow at 550 cfs. With the maximum capacity of the channel downstream of King Road at 600 cfs, it was found that the King Road Bridge has little effect to water surface elevations.

4.0 HEC-RAS Model of the Proposed Bypass

4.0 HEC-RAS MODEL OF THE PROPOSED BYPASS INCLUDING A DIVERSION FEATURE FROM UPC

The proposed bypass would be a box culvert with a design capacity to carry the 100-year event overflow of the natural channel. The alignment would be located between the proposed Upper Penitencia Creek diversion, approximately 170 feet upstream of King Road, under King Road, aligned along the Aetna and Salimoni property line (the bypass will be on the Salimoni property south of the property line), under the Union Pacific Railroad tracks, along the south Flea Market fence, and intersect Coyote Creek approximately 1,200 feet upstream of the natural confluence with Upper Penitencia Creek.

The location of the proposed flow split and diversion is where the existing bypass upstream of King Road terminates. In the interim condition, the capacity of the natural channel is 400 cfs, the existing bypass is upstream of King Road is 1,600 cfs, and the downstream reach of the natural channel below King Road is 600 cfs. Without in-channel or levee improvements, the natural channel capacities are not expected to change but in the future condition the bypass will be improved to handle the 100-year event of 4,140 cfs.

PROPOSED BYPASS FEATURES

The bypass channel proposed in HDR's initial hydraulic analysis discussed two different alternatives for the bypass channel design. Both designs call for a channel with a cover. The option to have an open top bypass channel was abandoned. The property value of the proposed bypass alignment is very expensive, thus SCVWD negotiated an agreement with the landowners to allow the construction of the bypass channel as long as the channel was covered.

Review of topics covered in the HATM:

- The two designs analyzed for the bypass channel were a single box culvert and a double box culvert.
- The single box dimensions call for an inside span of 28ft wide and 14-foot depth at a slope of 0.15%.
- The double box called for two box culverts, each with inside dimensions of 13.5ft span by 14ft depth at a slope of 0.3%.

R-C.
Pre-Cast
Conduit.

Single Box S= 0.15% propose
move up to allow sediment move
S say S= 0.25%

Arch

$2500/ft $3400/ft

36' wide

36'x15'
Custom Design

5 ton/section

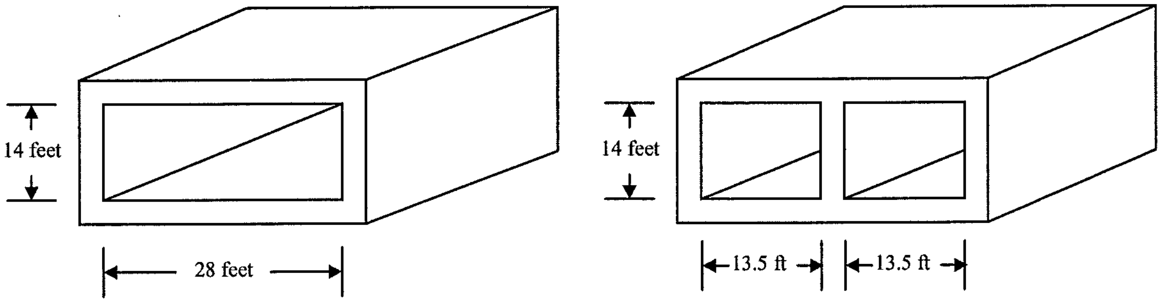
- The single box offers more hydraulic advantages than the double box (covered in the next subsection).

- The single box is less likely to be obstructed from large debris if it would be washed into the bypass channel.

- Maintenance of a single box would be less labor intensive because there would be a single larger chamber to work in as oppose to two smaller chambers.

- The construction costs are $2,900/L.F. for the double box and $3,400/L.F. for the single box.

See Table 4.1 for split flow values and figure 4.1 for water surface profiles of the single box culvert. Table 4.2 presents the hydraulic performance for the 100-year event. See the appendix for the hydraulic performance for the 5-year, 10-year, 50-year, and 500-year events.



Single Box Culvert Bypass

Double Box Culver Bypass

Figure 4.1: Bypass Design Options

Bypass Model Results

The bypass model results suggest the single box is a better hydraulic design than the double box. A summary of the results are presented below.

- A single box will have less flow resistance than the double box since the water to surface area contact is decreased due to the absence of the centerwall that would be present in the double box.

- With a more efficient passage of flow, the single box has a milder slope thus increasing the drop elevation at the outlet. Increased drop at the outlet is necessary for energy dissipation of flow before merging channels with Coyote Creek.

- While both channels were designed to pass the 100-year event, with the increased efficiency of the single box over the double box, the single box allows the 100-year event energy line to be inside the top of box while the double box just keeps 100-year profile inside the box. In addition, the single box can also pass the 500-year event with the water surface just inside the top of box.

- See Table 4.1 for various Manning's values and effects to hydraulic conditions.

Table 4.1: Hydraulic Performance of the Single Box and Double Box for the 100-Year Event

Manning's "n"	Single Box				Double Box			
	Velocity	Depth	Specific Energy	Froude Number	Velocity	Depth	Specific Energy	Froude Number
0.010	16.79	16.79	13.33	0.99	16.74	9.17	13.52	0.99
0.012	15.30	9.82	13.45	0.87	16.23	9.44	13.54	0.93
0.014	14.02	10.70	13.75	0.76	13.76	10.40	14.71	0.80
0.016	13.15	11.41	14.09	0.69	13.46	11.41	14.18	0.70
0.018	12.48	12.02	14.44	0.64	12.50	12.29	14.64	0.64
0.020	11.92	12.59	14.80	0.60	11.81	12.96	15.03	0.59

BYPASS OUTLET

As discussed in the HATM, the byass channel outlet consists of an energy dissipation device in the form of a drop structure. The outlet was initially aligned to 12-degrees between Coyote Creek and the bypass outlet. This alignment has been realigned to 45-degrees. The details are explained in section 5.

DIVERSION FEATURE FROM UPC

The purpose of the flow split structure would be divert all flows in excess of the downstream capacity of the channel below King Road. The structure would also ideally be non-operational and blend in well with the natural aesthetics of the existing creek conditions. The entire lower watershed section is recognized as a steelhead migration corridor where adult steelhead utilize the upper watershed as their spawning ground. Thus, the flow split structure should not jeopardize their migration pathway and minimize change in the natural channel. The flow split structure should not introduce any additional migration stress to the fish than under existing.

FLOW CONSIDERATIONS FOR THE FLOW SPLIT STRUCTURE

Steelhead Protection Measures

The National Marine Fisheries Service (NMFS) has recognized UPC as one of the last remaining steelhead spawning streams in the Coyote Creek watershed, thus must be protected. NMFS has determined that flows less than the 2-year flow should remain undisturbed. The 2-year flow is what determines the physical characteristics of a stream. This flow establishes the pool-riffle interval, the majority of the sediment size and distribution, the sinuosity, and other physical features. For UPC, the 2-year flow is 400 cfs.

Flow Split Operation Conditions

The operational conditions placed on the flow split structure make the reliability of the performance difficult to assess. The structure must not begin operation until 400 cfs is exceeded and, under post project conditions, not allow any flow in excess of 600 cfs to pass King Road under the 100-year design flow. For the interim condition, 1,400 cfs must be diverted off channel while for the future condition, 4,140 cfs must be diverted. See Table 4.2 for flow split conditions.

Table 4.2: Flow Split Quantities For Capacity and 100-Year Event

	Before Flow Split- Combined Natural Channel and Bypass Channel	**After Flow Split- Natural Channel Only**	**Diverted into Bypass**	**% Of Flow Diverted into Bypass**
Pre-Project Flow Capacity (Existing Conditions)	2,000 cfs	600 cfs	1,400 cfs	70%
Post Project 100-Year Event (Future Build Out Conditions)	4,740 cfs	600 cfs	4,140 cfs	87%

Channel Capacity & Hydrologic Performance Duration

The upper watershed does not have any current flood control devices, thus runoff behavior is a direct function of precipitation intensity. The following runoff data was based on the 24-hour precipitation event. The runoff characteristics of the upper and lower subbasins were modeled using the unit hydrograph (UH) theory. The UH theory assumes that runoff characteristics is particular to a specified rainfall event and does not change as long as the duration of the rainfall does not change. For this particular model, the precipitation event was a 24-hour event. Each of the frequency storms, the 2-year, 10-year, 50-year, 100-year, and 500-year events had subsequent increases in rainfall intensity but not duration. The runoff characteristic only changes if the precipitation duration changes. Although the 100-year event peak flow for the channel above King Road differs between the existing and future conditions, the runoff duration is the same. See Table 4.3.

Table 4.3: Split Flow Discharge Durations for the 100-year Event

Event	Time to Peak	Runoff Duration Above 400 cfs	Time to Exceed 400 cfs	Runoff Duration Above 600 cfs	Time to Exceed 600 cfs
10-Year	17.75 hrs	17.25 hrs	10.5 hrs	16.50 hrs	14.25 hrs
50-Year	17.75hrs	27.5 hrs	8.5 hrs	23.5 hrs	9 hrs
100-Year	17.75 hrs	28.5 hrs	7.75 hrs	24 hrs	8.5 hrs
500-Year	18.00 hrs	34.75 hrs	5.75 hrs	28.25 hrs	7.5 hrs

5.0 Model Runs of Flood Frequencies and Alternative Project Configurations

5.0 ALTERNATIVE PROJECT CONFIGURATIONS AND MODEL RUNS OF FLOOD FREQUENCIES

The bypass system is composed of three specific sections, the inlet, bypass channel, and the outlet. Each section will be discussed in further detail. The design flow for the bypass system is for the future 1% flow event of 4,740 cfs. As discussed previously, the existing system can only deliver 2,000 cfs. The flows to be used for the analysis of the bypass system are as follows: minimum flow condition (2-year event for steelhead), the maximum capacity of UPC downstream of King Road, the existing maximum flow that the channel upstream of King Road can deliver, and the following events: 10-year, 25-year, 100-year, and 500-year.

Both existing and future condition were evaluated in order to determine the performance of the bypass system in the interim and future conditions. See the appendix for the HEC-RAS analysis output table results.

Since it was already determined that the removal of the King Road Bridge had negligible effects to the water surface elevation, the following models were performed without the King Road Bridge.

FLOW SPLIT STRUCTURE

The flow split structure was designed to meet several criteria set forth by the hydraulic conditions and the desires of SCVWD.

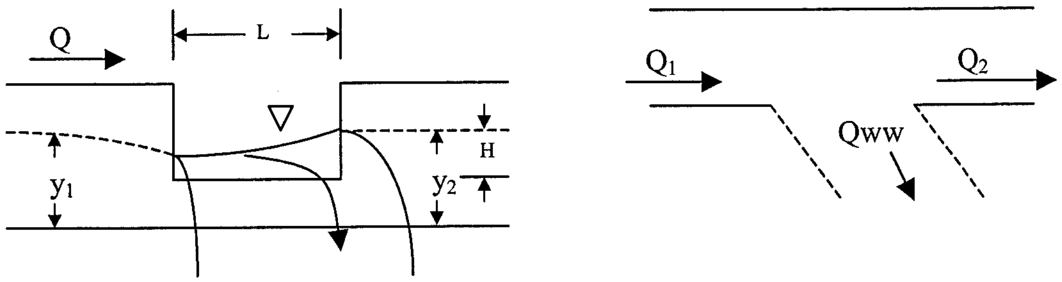
1) Accurately and predictably perform the split flow for the interim and future flood condition.
2) The flow split structure should be non-operational and passive.
3) Minimize long-term operation and maintenance costs while minimizing capital costs.
4) Begin diversion at the minimum 2-year flow of 400 cfs while not allowing more than the maximum capacity of the downstream channel of 600 cfs at the design 100-year flow conditions.
5) Minimize disturbance to the stream riparian aquatic (SRA) habitat and minimize disturbance to existing steelhead migration conditions.

6) Be aesthetically pleasing by having the potential to blend the structure in with the natural setting.

Each of the flow split alternatives suggested in the HATM were some form of a lateral weir. The lateral weir is a location on the bank of the channel that is lower than the surrounding bank. This allows the water to spill at a prescribed water surface elevation. By controlling the length of weir, the amount of flow that is removed from the main channel is also controlled.

Lateral Weir Flow Characteristics

One of primary concerns with the lateral weir performance was the predictability of the flow split. In an ideal lateral weir design for flood control, the flow throughout the lateral weir should remain subcritical, where y1 and y2 are the upstream and downstream flow depths, respectively, and Q refers to the flow. See figure 5.1 (a) and (b). With a lateral weir, the direction of flow that is split flows almost perpendicular to the flow in the channel. Q_1 and Q_2 refer to the upstream and downstream flow, respectively, while Qw refers to the split flow discharge. See Figure 5.1 (b).



(a)

(b)

Figure 5.1: Side Weir Flow Schematic. (a) Water surface profile of a subcritical flow split. (b) Plan view.

Discharge Coefficient for the Lateral Weir

The lateral weir is actually an embankment weir, which when overtopping occurs, creates a spatially varied flow condition. Various studies have been conducted to accurately model the lateral weir conditions for embankments and determining the proper discharge coefficient. One of the first published studies was by DiMarchi in 1934 and later followed by others to predict the flow over lateral weirs of various geometric types of channels, including rectangular, triangular, trapezoidal, and triangular and various types of lateral weir crests including sharp crested, rectangular, broad-crested, trapezoidal, and no weir. Many of the equations developed were based on the principal that the specific energy remains constant across the lateral weir opening (Das, 1997).

Various discharge coefficient (Cd) equations have been successfully developed using a multitude of equations and have been verified by experimental data. Three equations were used to calculate Cd, where each equation was a function of the Froude number (F_1) of the upstream side of the lateral weir.

$$C_M = 0.864\left(\frac{1-F_1^2}{2+F_1^2}\right)^{0.5}$$ (Subramanya and Awasthy, 1972)

$$C_M = 0.81 - 0.6F_1$$ (Ranga Raju et al., 1979)

$$C_M = 0.485\left(\frac{2-F_1^2}{2+3F_1^2}\right)^{0.5}$$ for w=0 (Hager, 1987)

Where C_M is the DiMarchi discharge coefficient, F_1 is the Froude number of the upstream approach flow to the lateral weir, and w is the height of the weir sill above the channel invert. DeMarchi formulated C_M with a different equation, but each of the above equations are the same as Cd. (Borghei et.al., 1999).

While various empirical equations were developed in calculating Cd, once the coefficients were obtained, they could be used in the general broad crested weir equation:

$$Q = \frac{2}{3}Cd\sqrt{2g}LH^{\frac{3}{2}}$$

where g is the gravitational acceleration, L is the length of weir, and H is the head over the weir or the height of water between the weir sill elevation and the water surface elevation over the sill.

HEC-RAS was used to model this the lateral weir flowsplit. In HEC-RAS, the terms $\frac{2}{3}Cd\sqrt{2g}$ was combined into a single coefficient, C for a standard weir equation of:

$$Q = CLH^{\frac{3}{2}}$$

For each of the equations, HEC-RAS runs were analyzed for the existing conditions for the 100-year event and the Froude numbers were obtained from the results. The Froude numbers were obtained for several cross sections in the vicinity of the upstream side of the proposed lateral weir location. The C was determined for each cross section and then averaged. This C value was determined to be 3.09. For conservative purposes, the design lateral weir coefficient of 3.0 was used. The typical range of C values range is 2.63-3.40. See Figure 5.2 for effects of various C values to the discharge with H and L constant.

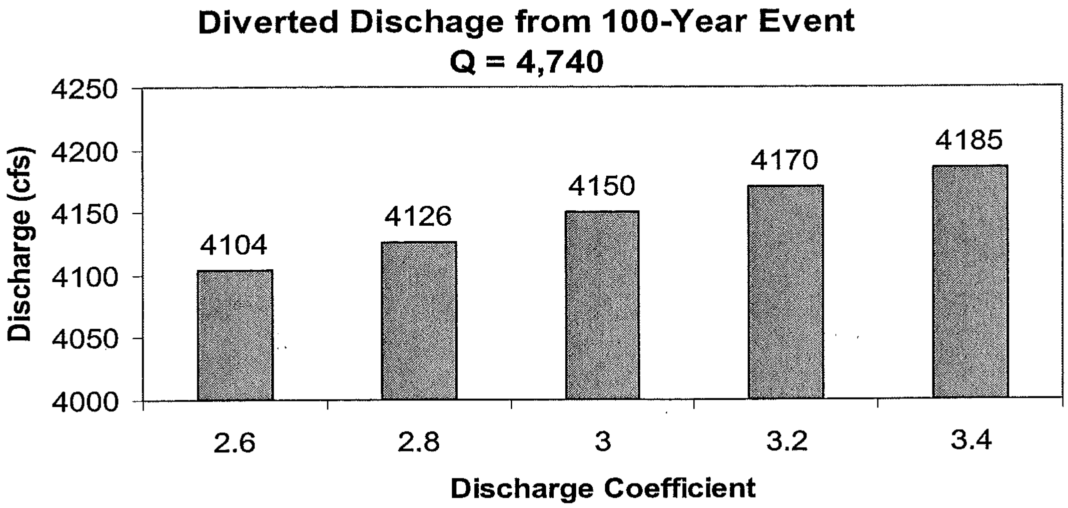


Figure 5.2: Efficiency of the lateral weir diversion with respect to changes in the discharge coefficient, C.

A difference of 0.2 per coefficient of lateral weir changed the total discharge diverted by a range of 15-24 cfs, thus the efficiency of the weir coefficient does not have as much effect to the total discharge diverted as head, H. H has the most effect since it has an exponent of 1.5.

In-Line Weir Characteristics

One of the issues raised about the performance of the lateral weir was the reliability of the performance to split the adequate flow quantity. In a typical weir where the orientation of the weir is perpendicular to the direction of flow, the discharge over the weir was very predictable. The weir causes the flow to back up on the upstream side where the depth of water increases and flow decreases to a negligible magnitude. The amount of discharge over the weir is then dependent almost solely on depth of the flow that is flowing over the weir. With the lateral weir, the velocity component is not negligible and the water surface elevation becomes a variable flow condition. This effect can be minimized by decreasing the flow velocity in the main channel that is parallel to the orientation of flow.

A method of increasing the reliability of the lateral weir was to construct an in-stream water surface control structure in the form of an in-line weir in conjunction of the lateral weir. The orientation of the lateral weir is perpendicular to the direction of flow in the channel. The water surface control structure allows the flow to back up on the upstream side of the in-line weir, which served two functions: first, the water surface elevation was increased to a predictable level and second, the increased depth caused by the in-line weir increased the performance head over the weir, thus decreasing the length of the lateral weir by facilitating an increase in flow over the lateral weir per unit length.

Steelhead Concerns With An In-Line Weir

With a fixed concrete in-line weir, steelhead passage must be evaluated. Adult steelhead have been found to have burst velocities up to 26.5 fps and prolonged swim speeds up to 10.2 fps (Bell, 1973). In addition, peak flow velocities during the 1% storm occur very rarely and for a short period of time relative to the migration season, which lasts for months. Furthermore, steelhead tend to remain stationary during flood peaks and migrate during the recession limb.

Sedimentation and Debris Concerns

There was a great deal of concern about sediment and an active bedload in UPC that would negatively affect the performance of the flow split structure and changing the channel morphology around the flow split location. These concerns were based on the sediment budget reported in the 1990 NRCS report where the estimation was 52,000 tons a year. However, a more recent analysis was conducted by Philip Williams and Associates (PWA) in July 20, 2001, "Upper Penitencia Creek Reconnaissance Level Sediment Assessment: Existing Conditions Summary."

PWA Sediment Report

In general, the PWA report noted a lower annual sediment budget than the 1990 NRCS report. PWA estimated the sediment budget using two methodologies, the Pacific Southwest Interagency Committee Method (PSIAC) and the Modified Universal Soil Loss Equation (MUSLE). See Tables 5.2 (a) and (b) for the results.

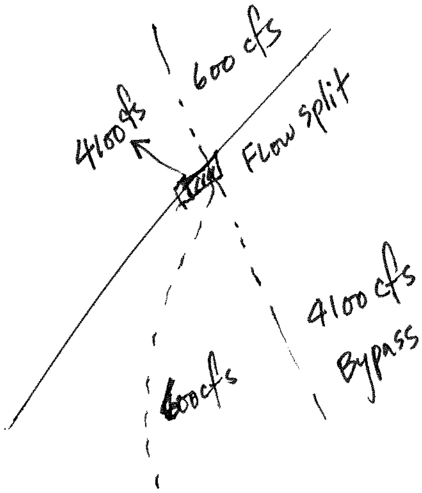
Table 5.1(a) Pacific Southwest Interagency Committee Method (PSIAC)

	Tons / Acre	Tons / Year
High Estimate	3.7	56,000
Low Estimate	2.3	35,600

Table 5.1(b) Modified Universal Soil Loss Equation (MUSLE)

Return Interval	Event Sediment Yield (tons)
2-yr	3,266
10-yr	12,354
25-yr	21,288
50-yr	26,712
100-yr	31,539

Sediment
under 680
(openig is wide)



PWA
Existig Conditon

The 52,000 tons/year estimated in the 1990 NRCS report falls just below the high estimate of the PSIAC method and well below the 100-year event estimated with the MUSLE method which is flood event based. The 100-year event assumed in the MUSLE method was 4,300 cfs. While the range of sediment yield varied significantly, PWA suggests that the low-end estimate of the PSIAC method is most likely which concurs with the MUSLE results. Although the PWA report generally shows lower sediment annual yields, the overall quantity of sediment is still high.

PWA reported the following characteristics about the watershed concerning existing conditions.

- Extremely active geomorphic unit
- Large volumes of coarse (>2mm) and fine sediment and is not limiting. Major source is eroding hill slopes.
- Little evidence of fine sediment deposition. It indicates that fines pass into Coyote Creek.
- 90% of bed material is made up of sediment larger than very coarse sands (1.68mm – 1.00mm).

Geomorphic process trend

- Tallent Avenue to King Road: aggradation (deposition)
- King Road to Coyote Creek: degradation (erosion)

A more critical issue revealed in the PWA study than the annual sediment yield was the analysis on the transport capacity of each reach in the channel. See table 5.2 on the reach analysis results.

Table 5.2: Reach Average Sediment Transport Capacity (Existing Condition)

Reach 1	Reach 2	Reach 3	Reach 4	Reach 5
Tallent Ave to Piedmont Rd	Piedmont Rd to Capitol Ave	Capitol Ave to east Mabury Rd crossing	East Mabury Rd crossing to King Rd	King Rd to Coyote Creek
4,160 tons/yr	2,295 tons/yr	313 tons/yr	298 tons/yr	958 tons/yr

In general, the transport capacity of each reach decreases from the upper most reach in the lower watershed at Tallent Avenue to King Road, where the transport capacity increases down to Coyote Creek. The bed materials range from cobbles and small boulder is reach 1grading down to sand/gravel/small cobbles in the lower reaches. In the low gradient sections, a coarse sand/fine gravel mixture covers the channel bed. There is also coarse sediment/fines mixture in the bypass channel. This suggests that the channel has been formed from mainly high magnitude floods emanating from the steep upper watershed. Channel avulsions (flows breeching the natural channel) have been exacerbated by local sediment depositions, raising the channel bed and by the partial blockage of the channel due to large woody debris.

From Piedmont Road (top of reach 2) down to King Road (end of reach 4) the range of sediment and transport capacity decreases drastically. The sediment transport capacity decreases at the same place where the majority of the flooding occurs in the 100-year flood plain, at Highway 680. Most of decrease in transport capacity is due to the combination of the flow restriction at Highway 680 and a milder bed slope. Reach 5, stretching from King Road down to Coyote Creek, is heavily incised, relative to the surrounding land surface. The bed material ranges from sand-gravel to cobble. There is little evidence of channel erosion activity.

Sediment Synopsis

In the existing condition, there does not appear to be excessive sedimentation in the channel reach in the vicinity of King Road. The King Road reach has the lowest gradient and is at the end of the aggradation reach, which suggests that the flow split structure will not experience excessive sedimentation. King Road is in reach 4, which has a relatively mild slope and the lowest transport capacity, thus much of the coarse material that makes to this reach is deposited at the top of the reach. Also, King Road is also at the cusp where the channel changes from aggradation to degradation thus fines that reach King Road are more likely to carry on down through to the degradation section of reach 5.

Woody Debris

Large woody debris has been common during flood flows. A likely source is Alum Rock Park, which traditionally releases entire trees. In addition, the entire stretch of UPC is well shaded with adult trees that contribute woody debris as well. See Figure 5.3 for debris photo at King Road.

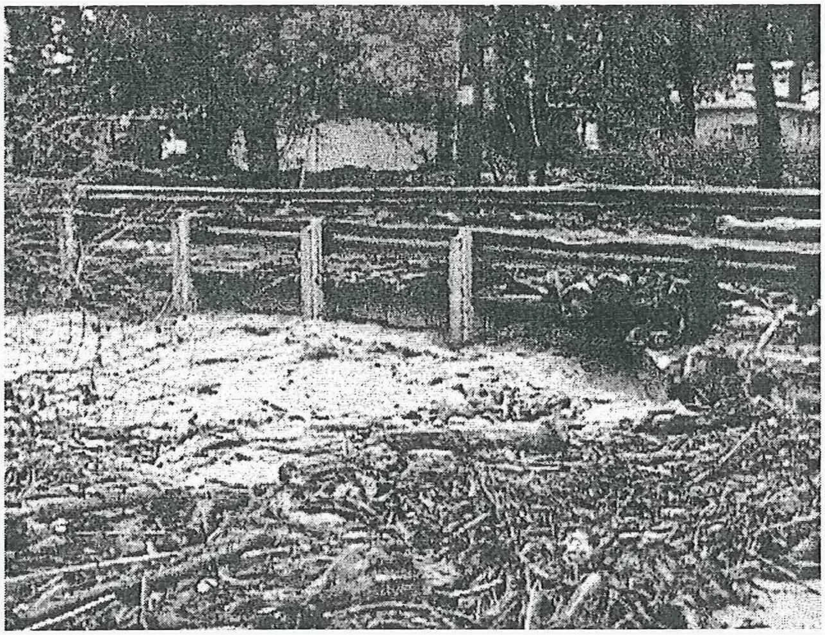


Figure 5.3: High water and debris at UPC and King Road, 2-3-98. (Courtesy of SCVWD O&M)

REVIEW OF INITIAL HYDRAULIC ANALYSIS TM ALTERNATIVES

The alternatives presented in the HATM are presented here. For more detailed explanation, please refer to the HATM.

1) Rubber Dam Lateral Weir Without An In-Stream Control Structural

2) In-Line Weir and Lateral Weir System

3) In-Line Inflatable Dam and Lateral Weir

4) King Road Bridge Weir and Lateral Weir System

Each alternative is a variation of the following components:

In-Stream Control Structure Alternatives

- In-Line Concrete Notched Weir
- In-Line Inflatable Dam/Weir
- Flow control using the King Road Bridge

Bypass Inlet Structure Alternatives

- Fixed Lateral Overflow Bank Weir (both variable and fixed elevation weir heights were considered)
- Lateral Inflatable Dam and Weir

Flow Split Alternatives

Inlet Alternative 1: Lateral Weir Without an In-Stream Structure (Stand Alone Weir)

The lateral weir would be located approximately 200 feet upstream of the King Road Bridge

See the appendix for the Lateral Weir alignment.

The downstream edge of the lateral weir would intersect the north side of the proposed bypass channel. The alignment of the weir would follow the centerline of the existing southwest levee of the natural channel and 460 feet long. The cross section of the weir would be horizontal at the sill of the weir from the channel bank to 2 feet past the center line of the existing levee. Then downstream face will have a 1:1 slope transitioning into an overflow channel that will run along the levee until intersection with the head of the bypass channel. The height of the weir and slope varies between sections along the length of the weir. The slope generally follows the water surface profile for the 400 cfs flow regime. Since flows would not be diverted until 400 cfs is exceeded, the associated water surface was used to determine the profile and height of the weir. In the HEC-RAS profile of the weir, the weir is shown in sections but the actual design will be one continuous weir with, changes in the profile slope. The weir was partitioned for modeling computation purposes.

Table 5.3: Split Flow Quantities (cfs)

Event	Discharge Before Diverted	Discharge Diverted into Bypass Channel	Remaining in Natural Channel
2-year	400	0	400
2.8-year	600	176	424
10-year	1800	1310	490
12.5-year	2000	1500	500
50-year	3500	2950	550
100-year	4740	4140	600
500-year	6290	5360	930

Pros/Cons of Inlet Alternative 1

The design for the lone lateral weir is essentially hardened embankment thus construction costs is minimized by the absence of additional structures. The structure is also designed to the gradient of the natural bed and hydraulic characteristics of the channel thus the proper performance of the weir is not likely to cause drastic changes to the bottom configuration. Even if the discharge coefficient, Cd, should not accurately reflect the performance of the weir, then at worst, the weir not perform to the design flow for the future 100-year event. This will be far into the future when the rest of the flood control project is completed and the entire 100-year event can actually be delivered to the King Road diversion site.

Environmental impact is also minimized. While bank SRA habitat will have to handled, there will be little to no disturbance of the channel bottom and opposite bank. Also, by keeping the structure out of the channel, when flows are less than 400 cfs, no new disturbances will be introduced to steelhead migration due to this project.

The performance is in compliance with SCVWD's desire for a non-operational flood control structure. There will not be any dramatic disturbance to the creek setting and modifications can be made to the aesthetics of the weir to make it blend in with the surroundings. Since the weir length will be designed to the future design 1% event, the structure would perform in both the interim and future condition. With the interim maximum flow condition being 2,000 cfs the weir would perform it its design even if debris should partially block a portion of the weir segment. In the unlikely chance that the structure should fail to perform to its design potential, flood conditions will not be any worse than pre-project conditions.

The negative aspect of this design is that the splitting of the flow may cause sedimentation. As discussed earlier, it is not likely that the weir location will experience excessive sediment loads but should it be so, changes to the channel bottom in the form of aggradation (deposition) will cause flow less than 400-cfs to be split. The extent of the maintenance is not known but when it is required, there may be some issues concerning obtaining permits to removing in-stream gravel.

Inlet Alternative 2: In-Line Weir and Lateral Weir System

This alternative would accomplish the flow split using a combination of an in-line notched concrete weir and a lateral weir. The lateral weir will follow the same configuration of the previously explained lateral weir but an in-stream structure would be constructed on the downstream edge of the bypass channel

The In-Line Notched Weir is a concrete weir, which would be built in the natural UPC channel just downstream of the bypass and oriented perpendicular to the flow direction, with a 10-foot wide rectangular opening about the centerline of the channel. The weir would be built to within 1 foot of the top of the left bank (facing downstream). The function of the weir is to decrease the flow area, which causes the flow on the upstream side to slow and the water surface to rise. An increase in the upstream elevation of the water surface increases the overflow performance of the lateral weir, thus the actual length would be reduced compared to the Inlet Alternative 1.

The purpose of the notch is to maintain a passageway for the migration of both adult and young steelhead. During most flow conditions, the flow would pass through the notched opening, the flow remaining continuous with the channel bed as it is with existing pre-project conditions. Flow velocities increase through the notch do due to the reduced cross-sectional flow area. It is not likely that the notched weir would be a steelhead barrier. For the 1% design flood, the discharge velocity on the downstream side of the in-line weir notch ranges from 10.9 fps to 12.7 fps for the 2-year and 100-year flow, respectively. Steelhead should be able to pass the notched weir, even during the 100-year event. With steelhead have burst velocities of 25 feet per second, adult steelhead should be able to pass during the worse case scenario. However, flow velocities decrease dramatically during the recession limb of flood when steelhead are known to move following a flood event. An in-stream weir blocked with debris would however, become a fish barrier. Thus it would have to be cleared when safely possible after storm events.

In-Line Weir Effects to Sedimentation

Changing the flow velocities is certain to change the natural stream shape or morphology. As a consequence of manipulating the natural flow behaviors with an in-line weir, sedimentation would occur on the upstream side due to decreased flow velocities and scour would be promoted on the downstream side due to increased velocities. During the 1% flood, velocities through the notch will be approximately 12 feet per second (fps). As water velocities slow leading up to the notch, the larger sediment will deposit on the upstream side. Over time, there may be enough sediment deposition to change the shape of the channel upstream of the weir system, thus affecting the flow split ratio over time. The channel bottom downstream of the notch weir would have to be armored to protect against scour of the bottom and undercutting of the concrete in-line weir. In order to insure the proper performance of the weir, O&M measures may be high.

Pros/Cons of Inlet Alternative 2

The advantage to adding an in-line weir would be as stated previously that the water surface elevation would be more predictable. With a more predictable water surface elevation, the lateral weir sill would not have to be shaped to the bedslope since the water surface would more controlled. With the notch in the in-line weir, the backflow condition would not be like as predictable as a reservoir but it would certainly be more predictable than if the in-line weir were absent. Water velocities on the upstream end would slow thus facilitating a more efficient flow over the lateral weir. The length of the lateral weir would also be shortened, but since there is adequate right-of-way along the bank where the lateral weir would be constructed, a shorter length weir would not necessarily be an advantage. Also, this alternative is non-operational

The disadvantage is adding a structure automatically changes the hydraulic flow characteristic to one that is not experienced previously. In addition to the change in the sedimentation behavior, a blockage to the notch is very likely given the history of large woody debris that is known to wash down during high flow events. The addition of an in-stream structure increases the water surface elevation of the upstream side of the in-line weir. Should the lateral weir not perform to its capacity and the notched weir become blocked, water surface elevations between King Road and Jackson Road would rise, possibly exacerbating the potential to flood in which case conditions would be worse than pre-project conditions.

Inlet Alternative 3: In-Line Inflatable Dam and Lateral Weir

An alternative to the concrete in-line notched weir would be an in-line inflatable rubber dam. The inflatable dam would stretch completely across the entire channel. The bladder would be cylindrical and inflate like a giant balloon. Once inflated, the dam would operate much like a typical cofferdam causing flow to backup and rise on the upstream side. The overflow and side diversion would be almost as predictable as a traditional permanent dam.

Rubber dams have been used for several decades now for a variety of hydraulic control structures including flood control in detention basins, increasing the temporary storage capacity of reservoirs, etc. Their performance has been proven effective and durable in other engineering projects.

Operation of this structure would only occur during potential flood events. It would remain deflated during low flow conditions, thus eliminating many of the problems associated with a fixed in stream device. During a potentially damaging flood event, the dam would be inflated, backing up UPC flows and causing water to divert to the bypass channel more efficiently than the in-lined notched weir. Although this alternative was not modeled, the lateral weir would be shorter the notched weir design. The control for the inflatable dam can be accomplished automatically and remotely. The control shelter would need to constructed somewhere near the structure.

Pros/Cons of Alternative 3

The advantages of this alternative would the increased efficiency of the lateral, decreasing the length of the lateral weir even more than the inlet alternative 2. The hydraulic performance would be the most predictable under these conditions. In addition, the control mechanism for this structure can be accomplished automatically, and if necessary, remotely. The impact of associated with an in-stream structure is limited. Impact will only occur during high events. Impact to fish migration and debris blockage will only be an issue during these events.

The disadvantage is that this alternative would still tend to cause sediment to deposit upstream, and could impede woody debris passage, although to a lesser degree than the fixed in-line weir. The inflatable dam would have to inflate very quickly during rising water. In the process of inflating, water would flow over the partially inflated bladder, cause in oscillation until the dam was fully inflated. Also, the capital costs are higher for the installation in addition to increase operation and maintenance concerns. These operational difficulties and uncertainties in this non-traditional engineering solution make this alternative less desirable than the equivalent fixed in-line weir.

Inlet Alternative 4: King Road Bridge Weir and Lateral Weir System

An alternative to the in-line weir idea is the use of the King Road Bridge as a water surface control structure instead of the in-line weir. Since the bridge is recognized for reconstruction, the bridge could be re-designed to perform as a hydraulic control device. Instead of building a concrete structure in the channel, the advantage of using King Road would be an additional structure would not be necessary. Modifications would have to be made to the bridge. A waterproof parapet and sluice wall would be installed on the upstream side of the bride deck that would cause flow to back up while preventing flooding on King Road. The parapet would be sized to only pass 600cfs and the lateral weir would work the same as in the previous alternative and sized appropriately to split the design flow off the main channel. The parapet would operate like a sluice gate where the critical flow depth associated with 600 cfs condition would be set during flood conditions. This alternative is very predictable since the opening allowing flow downstream is engineered. For this condition to work, moving parts would have to be employed. With the existing channel bottom geometry, there is only a foot of difference between the unimpeded water surface elevations associated with 400 cfs and 600 cfs. The parapet would have to lowered during the flood event to force the critical flow condition to limit downstream flows to 600 cfs, while the water surface elevation increases on the upstream side.

Pros/Cons of Alternative 4

This device is yet another alternative for a controlled engineered flow condition during high flow events. As in the other alternatives, the performance of the lateral weir would be more predictable and the flow split would be more efficient, thus shortening the length of the lateral weir. Other advantages are the same as in alternative 2 and 3. An additional advantage is that this engineering hydraulic control would not add an additional structure to UPC. The bridge must be re-constructed anyway.

One disadvantage is that this flood control measure must be operated. The parapet elevation would have to carefully controlled be controlled to the proper elevation when flows in excess of 600 cfs occur. The critical flow depth associated with the existing pre-project bottom geometry is less than one foot. Flow would be forced into the critical condition creating a hydraulic jump downstream of the King Road Bridge.

Another disadvantage is the potential for woody debris to block the passage of water at low flows. Since is blockage is right at King Road, the road would need additional protection to prevent the flooding in the case that the opening would be blocked. The diameter of sediment can be carried through the sluice gate would be larger what the flow could carry downstream of the bridge. Larger sediment would settle out if it were to get to the bridge. It was shown in the PWA report that there wouldn't be much sediment coming through. To prevent scour and in order to maintain the proper channel dimensions as the bridge, the bottom would have to be armored.

Alternative 5: Rubber Dam Lateral Weir Without An In-Stream Control Structural

Another alternative to splitting the flow would be through the use of a lateral inflatable rubber dam. The inflatable dam would operate like the fixed crest lateral weir except the opening of the channel would be shorter in length and overflow elevation would be almost to the invert elevation of the natural channel. The dimensions would be approximately 150ft wide and 3.5ft high. The dam would resemble a cylindrical tube bolted to a concrete foundation. The side contacts between the dam and the abutments would be sealed against leakage. During common flows less than 600cfs, the rubber dam would be inflated to perform like a levee or channel wall. During flood flows, the dam would be deflated and water would flow over the top of the low bank as in the lateral weir design. Since there would not be any in-stream devices, an advantage of the rubber dam is that normal flows in UPC and the stream morphology will be impacted. Fish would still be allowed an undisturbed passage as long as migration is not occurring during flood events. (Studies indicate that steelhead migrate mainly during the recession of the flood waters.) The level of the rubber dam could be controlled remotely and/or automatically. In the case of power outages, there is a fail-safe non-electrical mechanism for deflating as well. Rubber dams have been proven to be resistant to damage from metallic objects as well as woody debris. Special provisions can be provided to protect the rubber from knife damage and bullet holes.

Pros/Cons of Alternative 5

The inflatable lateral dam also has the advantage of passing sediment during flood events, because the sill elevation of the deflated dam would be much lower than the weir elevation of a fixed lateral weir, and no in-line structures would be required. In addition, control can be accomplished automatically. Failure of this bladder to remain inflated will not cause flooding, rather, will reduce flows in the natural channel below King Road.

The disadvantages to this alternative are several. This alternative would require operation during flooding events. The controls would require maintenance and periodic calibration. This alternative is also more costly in capital costs and long term O&M costs. Finally, this alternative may not be aesthetically pleasing. Some effort would have to be made to disguise the presence of an inflatable dam.

Conclusion of the Inlet Alternatives

In response SCVWD's comments following the HATM, the alternatives that would be considered and further evaluated will be Inlet Alternatives 1 and 2.

Transition Channel Between the Flow Split Structure and Bypass Channel

The transition the split flow structure will require the use of the entire undeveloped area between the proposed alignment of the lateral weir and King Road. See the appendix for the plan view.

The transition would consist of a channel along the southwestern side of the left levee (facing downstream) of UPC, opposite the levee from the natural channel. The channel would be run parallel to the lateral weir, catching the entire overflow spill. The downstream face of the lateral weir will be a 1:1 slope transitioning into a bowl shape basin. The slope on the west side of the basin, between King road and the lateral weir would be a 1.5:1 slope. The inlet to the bypass channel would be have a radius of 80 feet, curving between the orientation of the lateral weir toward the bypass main channel. A beveled trash rack would be installed at the mouth of the channel to allow debris to float up over the bypass, deterring blockage. The trash rack would also serve as a barrier to keeping pedestrians out of the channel. A maintenance ramp will be provided from the mouth of the inlet on upstream along just outside of the levee wall. A wall will be constructed along the west side of the proposed maintenance ramp that will serve to deflect the water that is diverted off the UPC channel and into the bypass outlet. 45-degree wing walls on the bypass inlet will also facilitate proper drainage into the bypass.

Should the future pedestrian and equestrian trail pass through this area, then space for a trail will be adequate along the existing development wall to King Road. To cross King Road, a tunnel should be constructed under King Road with an access ramp back to the surface street to be oriented northward along King Road.

BYPASS CHANNEL DESIGN ALTERNATIVES

The descriptions of the bypass alternatives have been covered in section 4. Both the single box and double box hydraulic performance will be evaluated.

1. Single box culvert: 28-foot span X 14-foot depth
2. Double box culvert: 2 boxes 13.5-foot span X 14-foot depth

THE BYPASS OUTLET

Under project conditions, UPC reaches it's peak flow at King Road for the 1% flood approximately 48 hours before Coyote Creek does (USACE, 1995), therefore, the diverted flows will not increase the peak 1% flood elevations in Coyote Creek. When the peak flows from Upper Penitencia Creek reach Coyote Creek, the flow in Coyote Creek is approximately the 30-year storm level or at elevation of 72 feet (Firth, 2001). At the bypass location, the top of the right bank of Coyote Creek is at elevation 83 feet, while the top of left bank is at elevation 76 feet, resulting in a 7-foot elevation difference between the left bank and right bank. When the bypass is flowing at design capacity, Coyote Creek water surface is at elevation 72 feet. The energy associated with the flow exiting the box culvert is very high and must be dissipated before entering Coyote Creek.

The following alternatives are designed to dissipate energy.

Bypass Alternative 1: Vertical Drop Structure and Deflecting Wall

See attached maps. Energy can be dissipated through the use of a vertical drop structure. The structure is similar to the transition structure between Upper Penitencia Creek and the bypass channel inlet. The drop structure span would be 28 feet, the same as the bypass channel dimensions. The length of the basin in which the jump occurs would be 50 feet. The drop would dissipate much of the energy and allow the flow to become tranquil (Froude number is less than 0.86). The elevation of the sill of the drop structure will be at 68 feet elevation. This elevation corresponds to about the 2-year stage elevation. See Table 5.5 for difference in velocity due to the drop structure.

Table 5.4: End of Bypass Velocity (fps) Decrease Due to Drop Structure

Flow Event	Discharge (cfs)	Velocity Before Drop (fps)	Velocity After Drop (fps)
5-Year	690	9.29	1.90
10-Year	1,310	11.50	3.10
50-Year	2,950	15.03	6.14
100-Year	4,150	16.84	7.72
500-Year	5,360	18.35	9.05

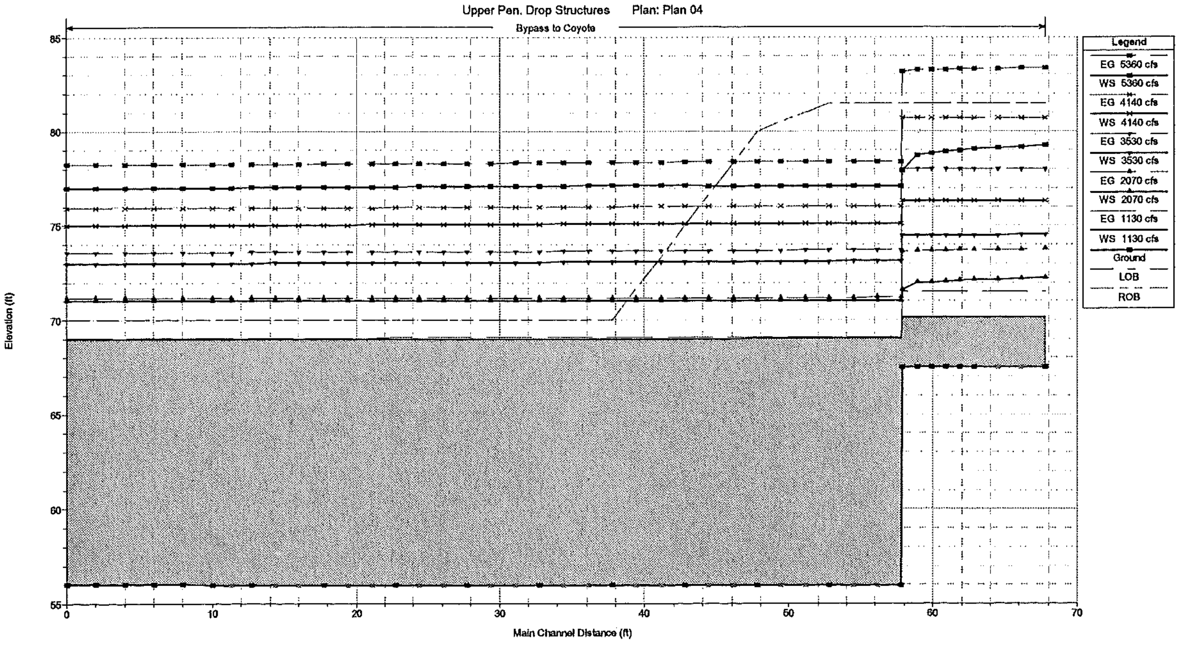


Figure 5.3: Bypass Outlet Drop Structure Water Surface Profile

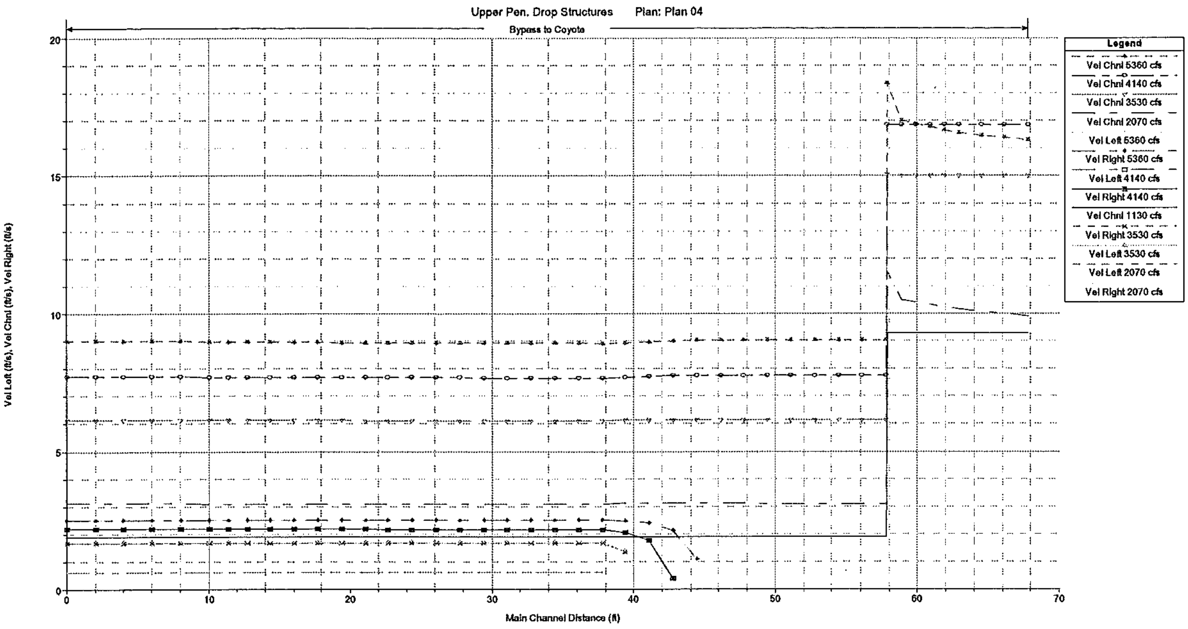


Figure 5.4: Bypass Outlet Velocity Profile

Immediately downstream of the toe would be a deflection wall that would serve to deflect the flow in the direction of Coyote Creek facilitating a smooth transition between the merging flows. The invert elevation of the deflecting channel would be the same as the adjacent Coyote Creek invert. The deflecting wall would be the height of the existing ground. Riprap would be used for scour protection along the exit channel invert outlet.

The HATM referred to a 12-degree deflection wall but this angle was redesigned to a 45-degree angle. The 12-degrees was a deflection angle that is recommended by the USACE engineering manual EM 1110-2-1601, "Hydraulic Design of Flood Control Channels," for smooth transition between merging channels of tranquil flow. In addition to the angle of approach, the EM recommends approximate equal water surface elevations, and extension of the width of the downstream channel. These measures aid in the elimination of standing waves and minimizing cross-wave formation and turbulence. The 12-degree angled wall would have been used to increase the energy dissipation as well as orientate the bypass flows into the direction of Coyote Creek. The 45-degree wall is not likely to aid in energy dissipation but will serve to orientate the flows downstream with Coyote Creek. It is not likely that the 45-degree wall will dissipate energy. But, the energy lost from the drop structure will suffice in the merging of the channels.

See appendix for bypass outlet alignment.

Pros/Cons of Bypass Outlet Alternative 1

Upon review of the HATM by SCVWD, the concern of the excessive negative impact to the SRA habitat took precedence over following the recommended design features of the EM. The 12-degree approach angle to Coyote Creek was such a gradual approach to the channels merging that approximately 260 feet of stream bank would have to be altered including the removal of almost all SRA habitat. A 45-degree approach of the bypass channel outlet would allow the bypass to merge with Coyote Creek at a more aggressive angle, which would be aligned to minimize impact to SRA habitat. At most, the 45-degree angle would affect 100-feet of stream bank. With the more aggressive approach angel, it is likely that standing waves and additional turbulence will result at the outlet requiring revetment on the east side of Coyote Creek, just downstream of the outlet.

The drop structure will not have any known adverse effects to natural channel; rather the energy dissipation will help minimize turbulent flows when the two channels merge. The invert elevation of the outlet corresponds to the 2-year event water surface elevation, thus any event beyond this will cause water to back up in the bypass channel. Any flow above the 2-year level and the bypass begins spilling. Effects to anadramous fish is uncertain. Flows above the 2-year event will inundate the invert as well as discharge out of the bypass will begin, which may promote steelhead to attempt to migrate up the bypass. The extent of this is not known.

Alternative 2: Vertical Drop Structure, Widened Outlet, and Riprap Banks

This alternative uses the same drop structure as alternative 1 but the deflecting wall would be absent. The general orientation of bypass approach flow would be 90-degrees to Coyote Creek. In addition, the channel would be widened at the outlet further slowing down the flow by causing the flow to spread out over a wider channel. The left wall of the bypass channel (the upstream side relative to Coyote Creek) would remain its 90-degree orientation toward Coyote Creek while the right side of the bypass channel would be widened to a 45-degree downstream orientation to Coyote Creek. Riprap would be placed at the bottom of the outlet channel. The riprap would increase the roughness of the channel thus reducing the flow velocity by friction.

Pros/Cons of Bypass Outlet Alternative 2

This alternative is not recommended because the flow merging from the bypass with Coyote Creek is almost a 90-degree angle, which would cause a sinusoidal transverse wave downstream on Coyote Creek. Riprap would have to be place along the banks where the transverse wave contacts the banks on opposing sides. In addition, extensive use of riprap would need to be employed which is likely to cause the loss of SRA habitat.

Alternative 3: Curving of the Bypass Alignment

Instead of using the deflector wall as in alternative 1, the alignment of the exit channel can be curved to meet Coyote Creek at a 12-degree incident angle. The curved alignment would impact the southwest corner of the adjacent flea market property.

Pros/Cons of Bypass Outlet Alternative 3
This alternative was abandoned because of the high cost of acquiring additional lands. Again, with the 12-degree approach, an abundant loss of SRA habitat is likely.

ALTERNATIVES CONSIDERED FOR PRESENTATION OF MODEL RUNS AND THREE FLOOD FREQUENCIES

Bypass Inlet/Split Flow Structure

1. Stand-alone Lateral Weir

2. Lateral Weir With In-stream Notched Weir

Bypass Design

1. Single Box Culvert

2. Double Box Culvert

Bypass Outlet

1. Drop structure with deflection wall.

2. Drop structure with widen outlet and increased riprap.

Model Runs of Project Alternatives and Multiple Flood Frequencies

Each of the alternatives will be modeled in the following combinations:

1. Stand-Alone Lateral Weir, Single Box Culvert, and Drop Structure With Deflection Wall

2. Lateral Weir With In-Stream Structure, Double Box Structure, and Widened Outlet

3. Stand-alone Lateral Weir, Single Box Culvert, and Widened Outlet

Flows Evaluated For the Bypass

The following scenarios were ran with the following events: 2-year, 2.3-year, 12.5-year, and the 100-year. The project flow split structure was designed to these flows. 400 cfs is the minimum flow which the bypass will begin diversion and 600 cfs is the maximum that will be allowed downstream. In addition, the 4,740 cfs is the design capacity of the structure but the 2,000 cfs is what the project will experience.

Table 5.5: Bypass Evaluated Flows Including the Design Flow and Other Significant Flows*

2-Year Minimum Flow	Channel Capacity (2.3-Year)	Existing Maximum Flow Delivery (12.5-year)	100-Year
400 cfs	600 cfs	2,000 cfs	4,740 cfs

*Based on USACE, San Francisco District UPC Hydrologic Engineering Office Report, January 2001.

Stand Alone Weir

The same boundary conditions used were the same conditions used in determining the channel capacity below King Road. The Manning's n values used were 0.50 for in channel and 0.40 for overbank. The downstream water surface elevation was 72 feet elevation at Coyote Creek.

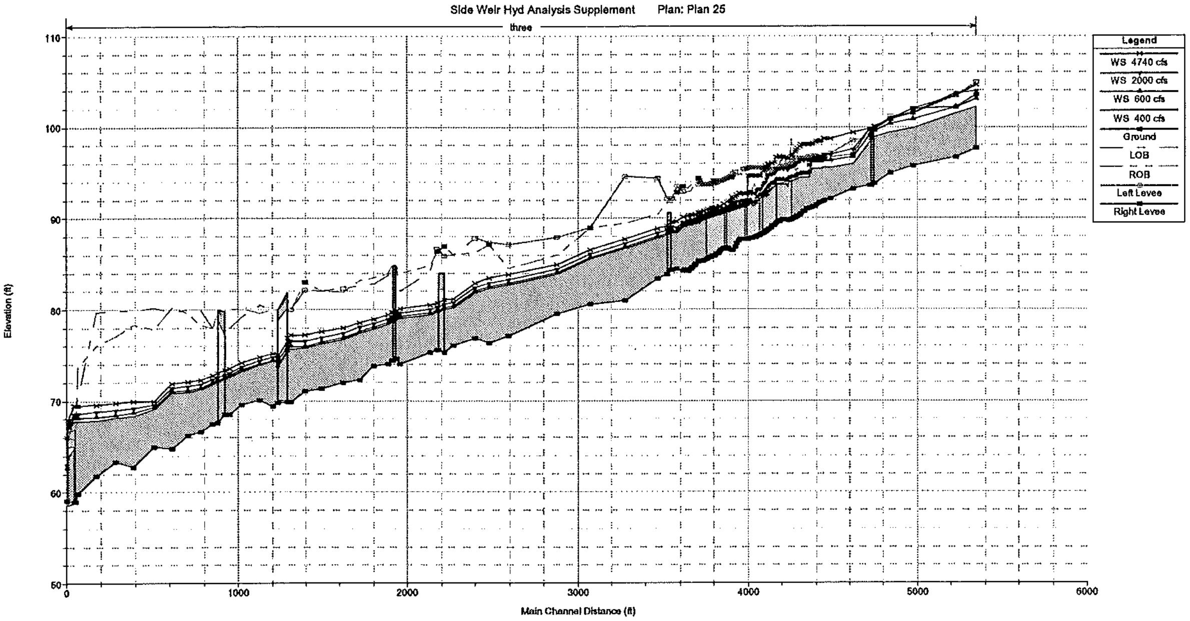


Figure 5.5: UPC Water Surface Profile From Stand-Alone Lateral Weir

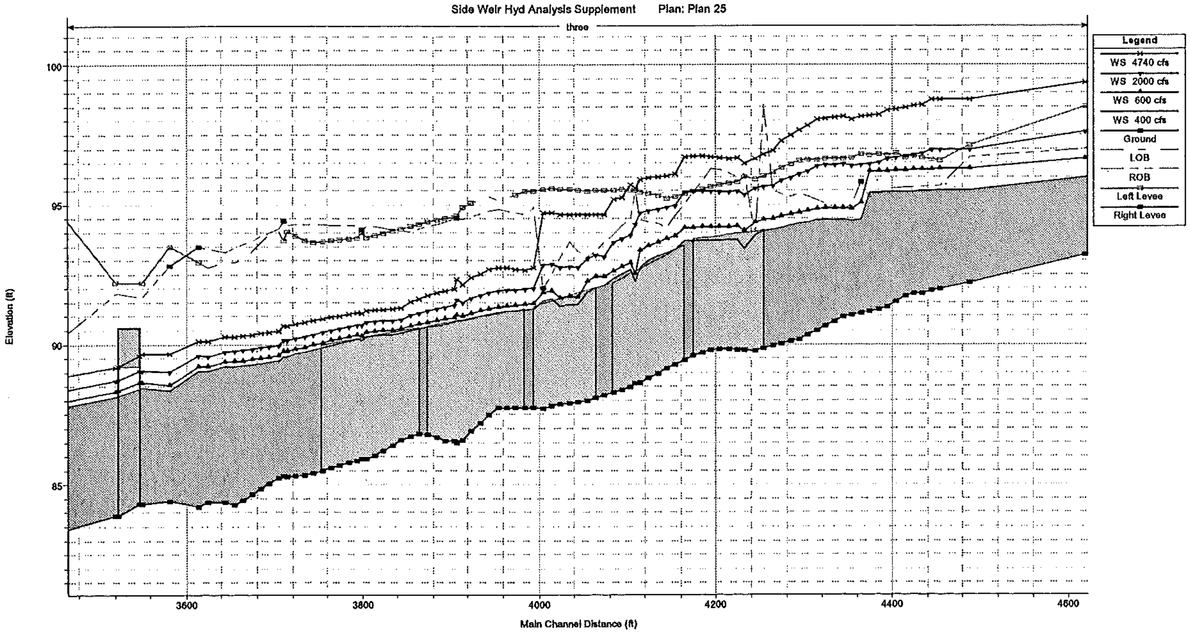


Figure 5.6: UPC Water Surface Profile for Stand-Alone Lateral Weir Close-Up

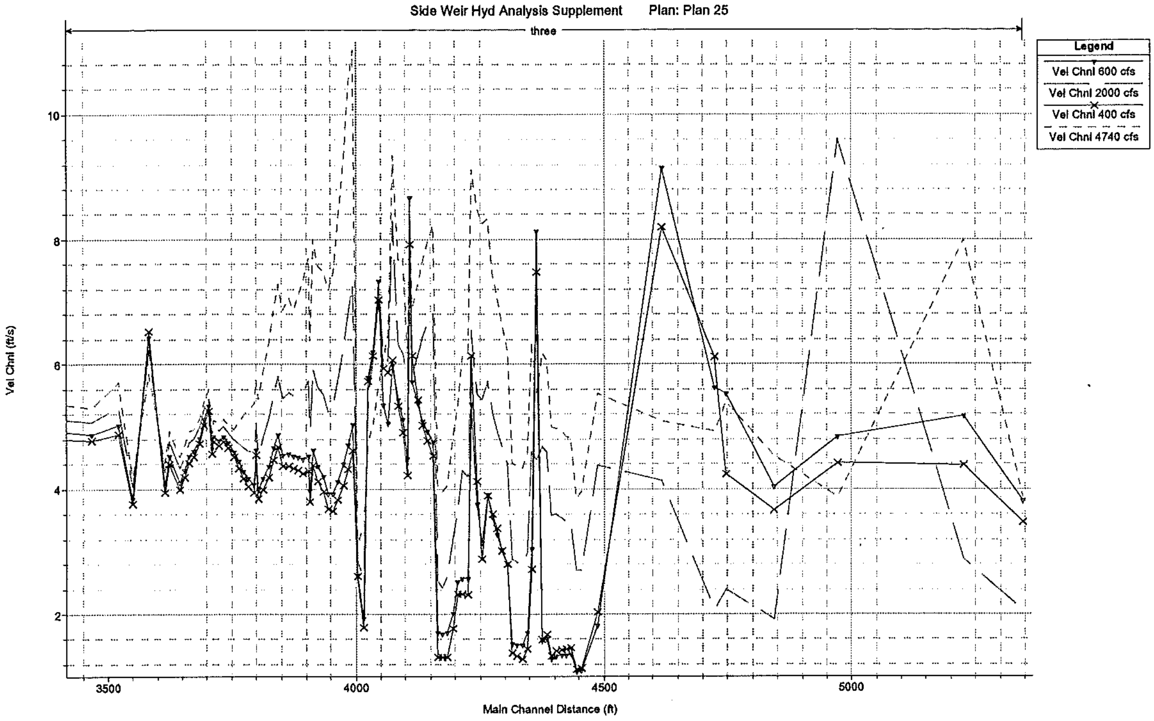


Figure 5.7: UPC Velocity Profile for Stand-Alone Lateral Weir

Velocities range from 4 fps to 11 fps for the 100-year event.

Lateral Weir With Notch

The boundary conditions and flow magnitudes used were the same conditions used in this alternative as in the Stand-Alone Weir. The notched weir dimensions were a 10-foot wide notch centered at the centerline of the channel located just at the downstream end of the lateral weir. See figure 5.4 for idealized cross section.

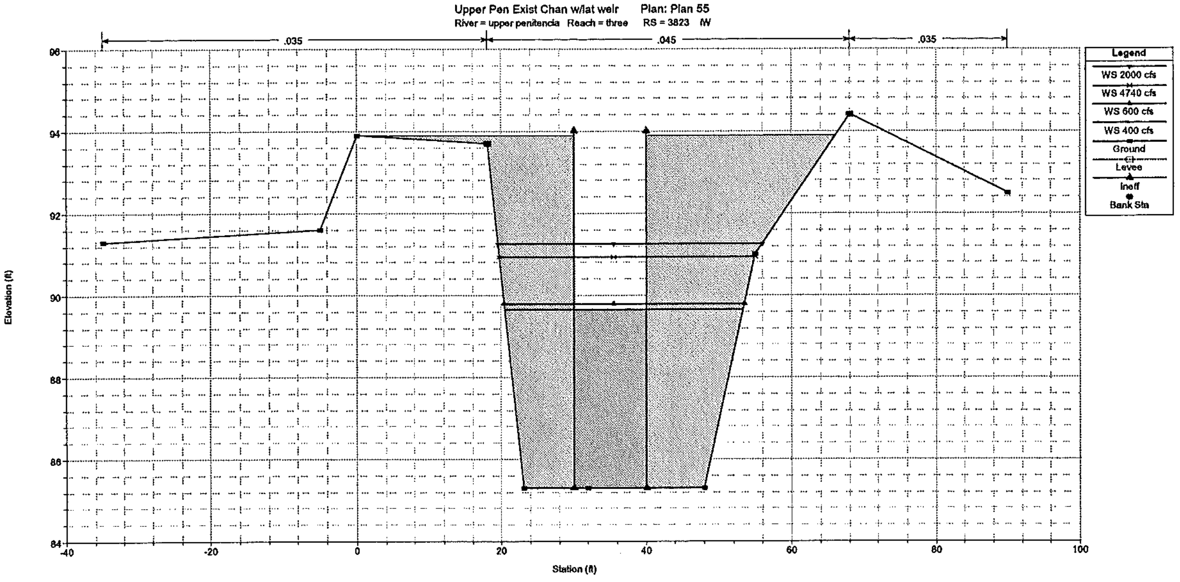


Figure 5.8: Notched In-Line Weir, Hydraulic Control Structure

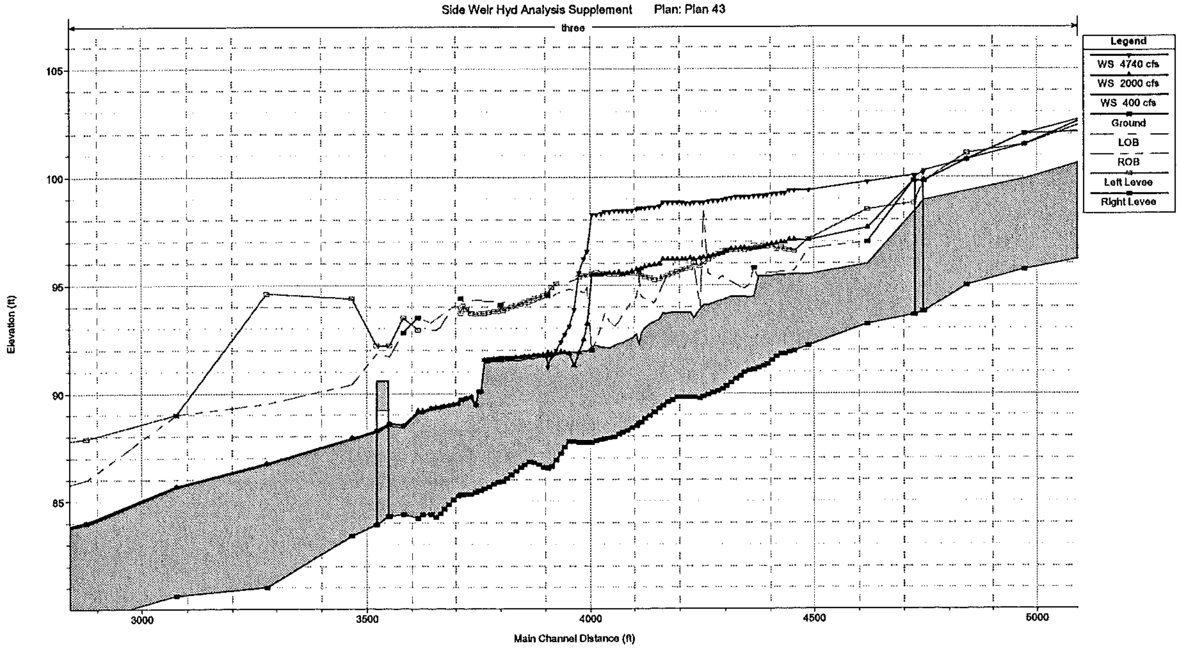


Figure 5.9: UPC Water Surface Profile From Lateral Weir With Notch

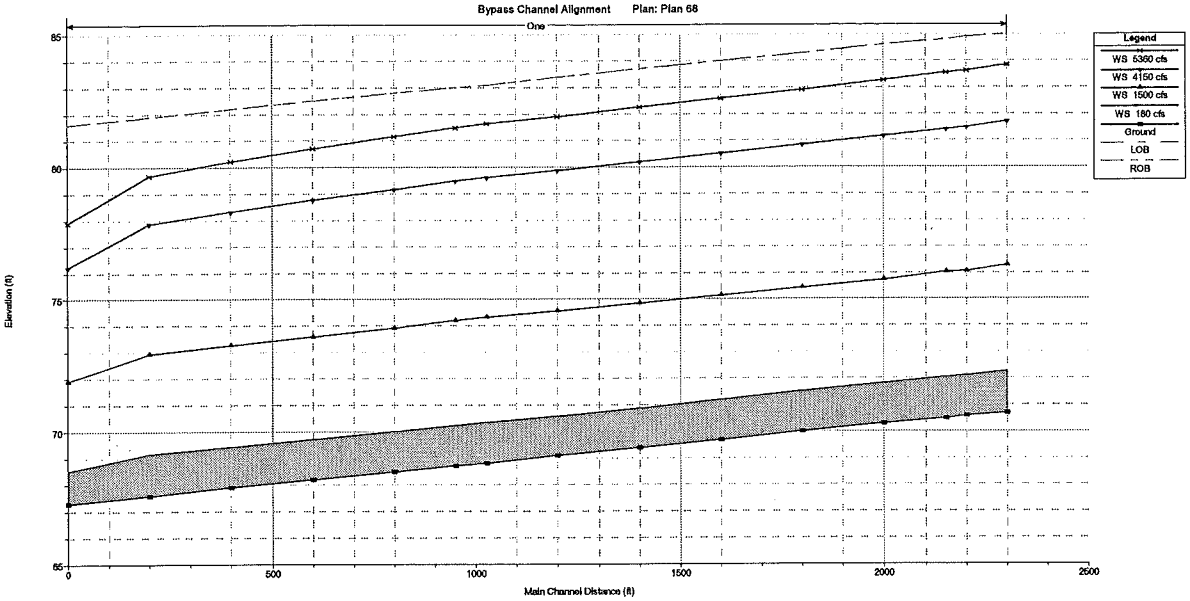


Figure 5.11: UPC Water Surface Profile for Single Box Culvert

The water surface remains a 1.5 feet of freeboard. for the 500-year event and 3.5 feet freeboard for the 100-year event.

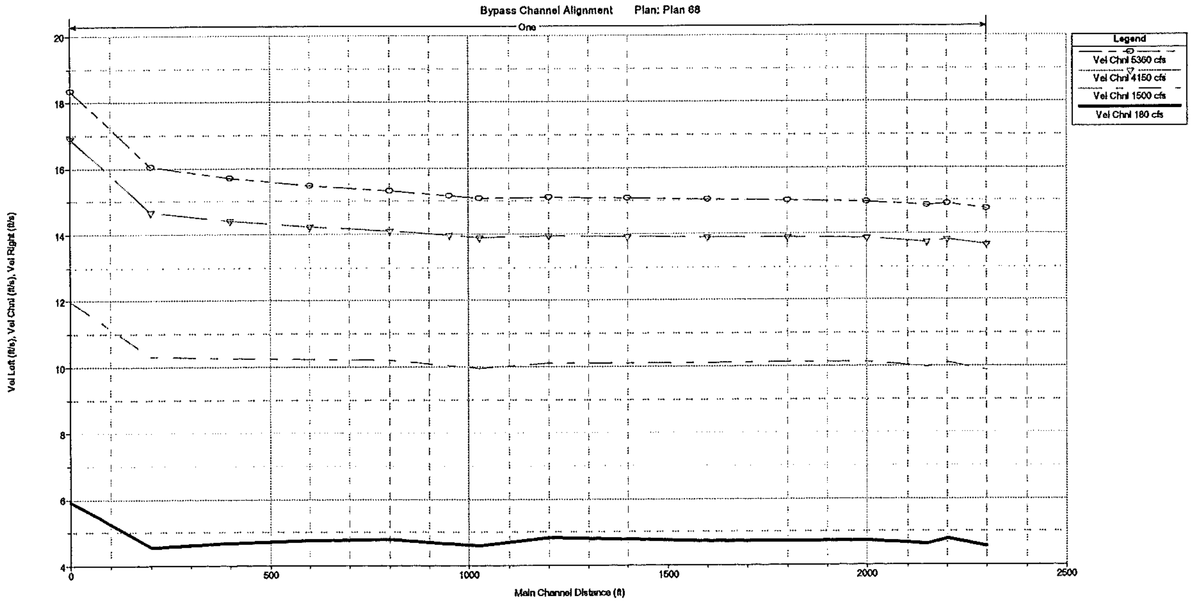


Figure 5.12: UPC Velocity Profile for Single Box Culvert

For the 100-year event, water velocities enter the channel at 18 fps and taper down to 14 fps after 1,000 feet into the bypass

Double Box Culvert

The same flow and boundary conditions were used as in the Single Box alternative.

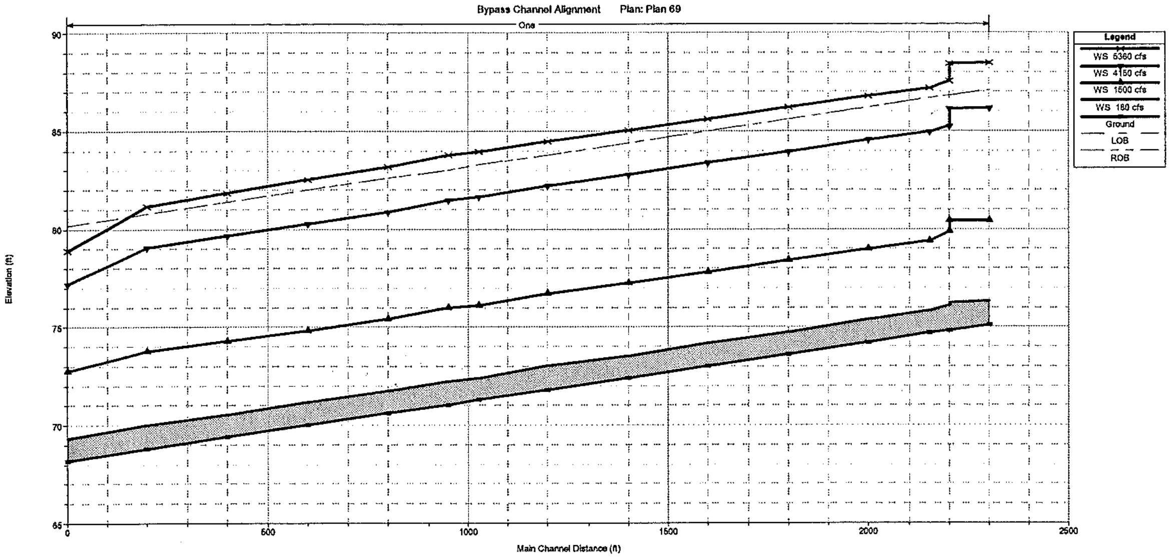


Figure 5.13: UPC Water Surface Profile For Double Box Culvert

For the 100-year event, the water surface is approximately 1.75 ft freeboard. The 500-year event is shown out of the top of the channel which is inaccurate since the box is closed. This would result in a pressure flow situation.

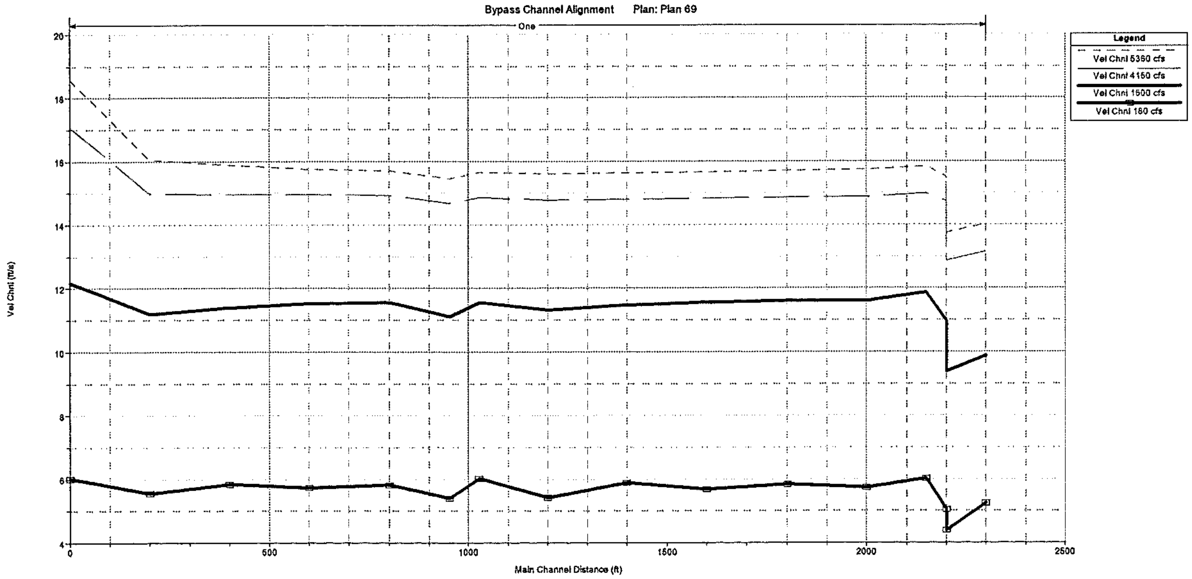


Figure 5.14: UPC Velocity Profile For Double Box Culvert

Water velocities start out the same as the single box but decrease more dramatically due to the increased water contact to surface area of channel. For the 100-year event, water velocities start at 17 fps and taper down to 15 fps. For the 500-year event, the water surface elevation exceeds the top of box thus the flow goes under pressure. The water velocity for the 500-year event is not shown.

Drop structure with deflection wall

This alternative is the same profile as the drop structure in Section 5. The deflection wall is not shown. It is not likely that the deflection wall would not be effective at dropping the energy, rather it will be used to orient the flow downstream.

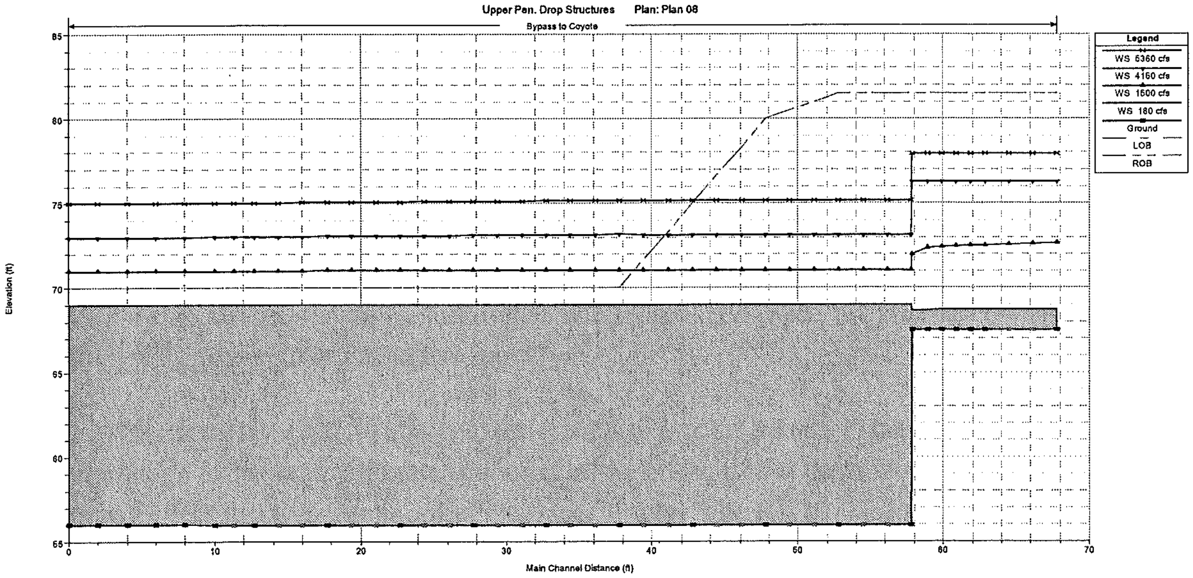


Figure 5.15: Bypass Outlet Drop Structure Water Surface Profile

Water surface elevations are 1 foot higher at 73 feet elevation than Coyote Creek's water surface of 72 feet elevation.

Table 5.7: Velocity Changes Throughout Drop Structure with Riprap

Event	Flow (cfs)	Before Drop (fps)	At the Toe of Drop (fps)	At End of Riprap Section (fps)
2.8-Year	180	5.39	0.49	0.18
12.5-Year	1,500	11.98	3.58	1.27
100-Year	4,150	16.85	8.98	3.08
500-Year	5,360	18.36	10.50	3.55

6.0 Presentation of Model and One-Percent Flood Profile

6.0 PRESENTATION OF MODEL AND ONE-PERCENT FLOOD PROFILE OF FINAL DESIGN CONFIGURATION.

The following is the recommended configuration for the flow split and bypass system

1. Stand-Alone Weir for the Flow Split
2. Single Box Culvert
3. Utilize the drop structure and 45-degree deflection wall to dissipate the energy

Stand-Alone Lateral Weir

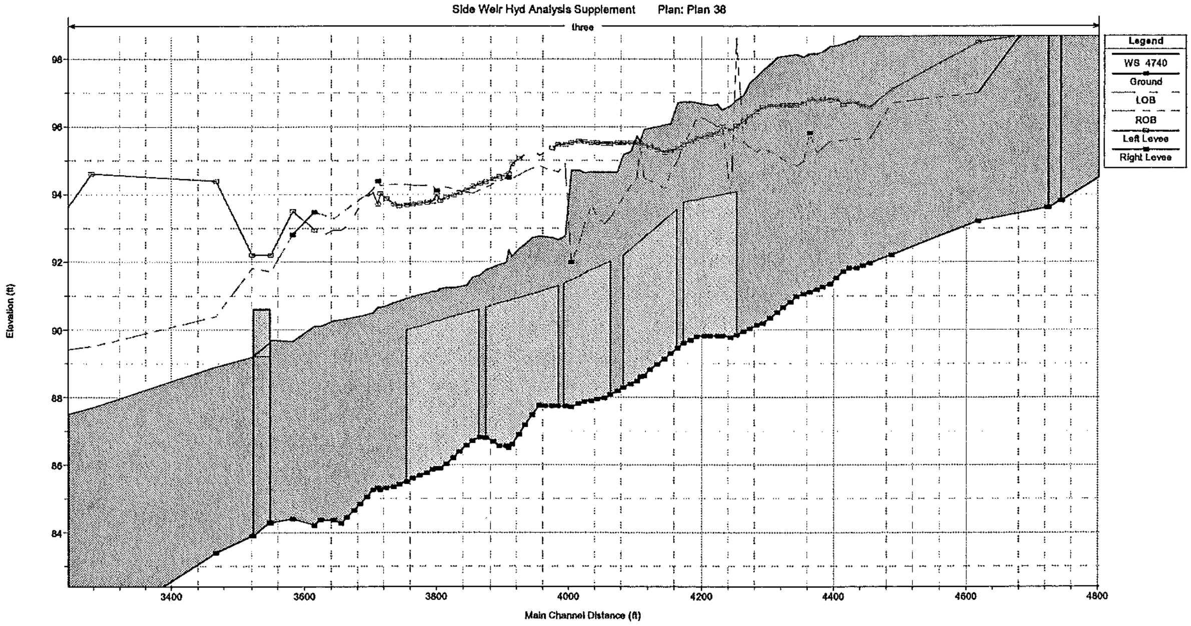


Figure 6.1: Water Surface Elevations for Stand-Alone Weir For Flow Split

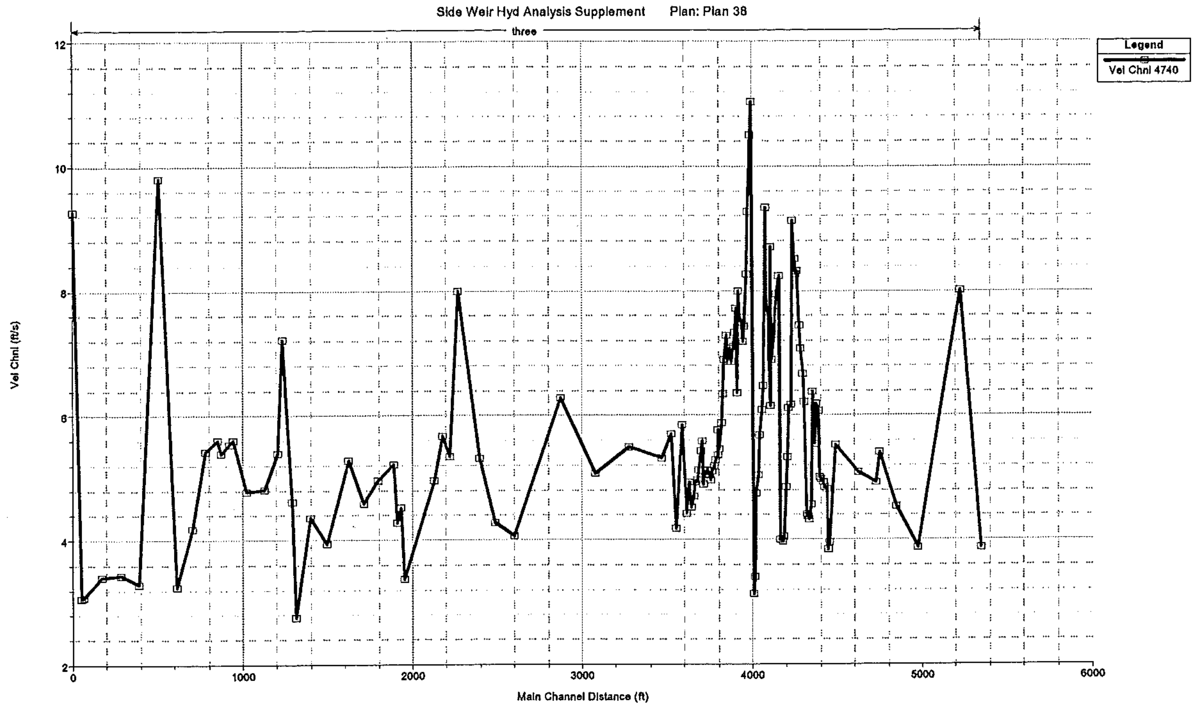


Figure 6.2: Velocities for Stand-Alone Weir For Flow Split

Single Box Bypass Channel

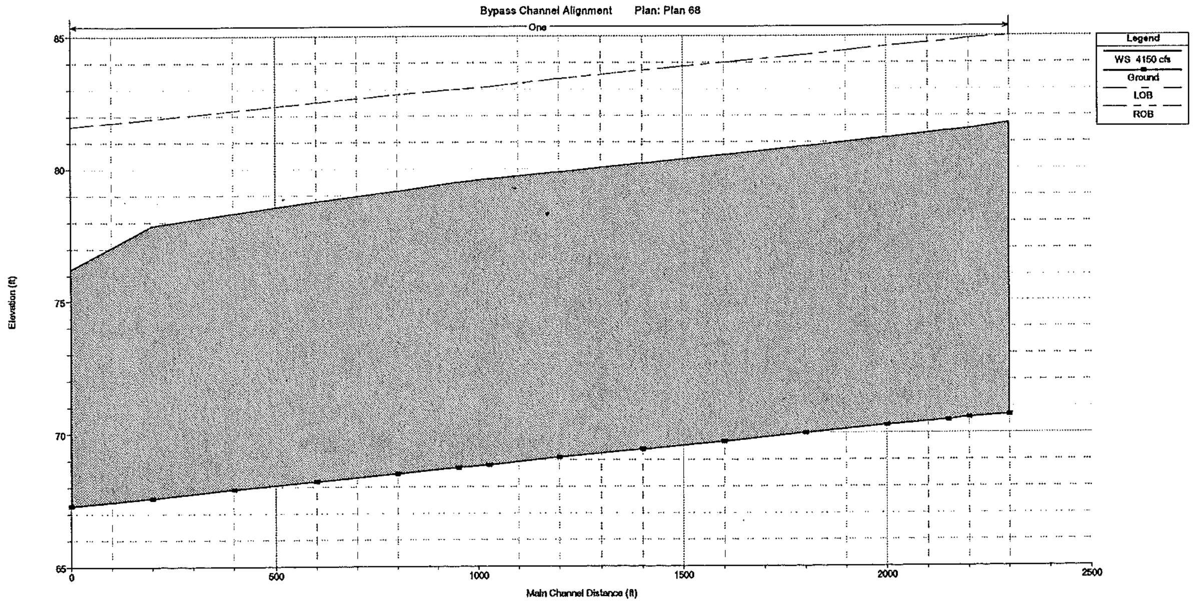


Figure 6.3: Water Surface Elevation for Single Culvert Bypass Channel

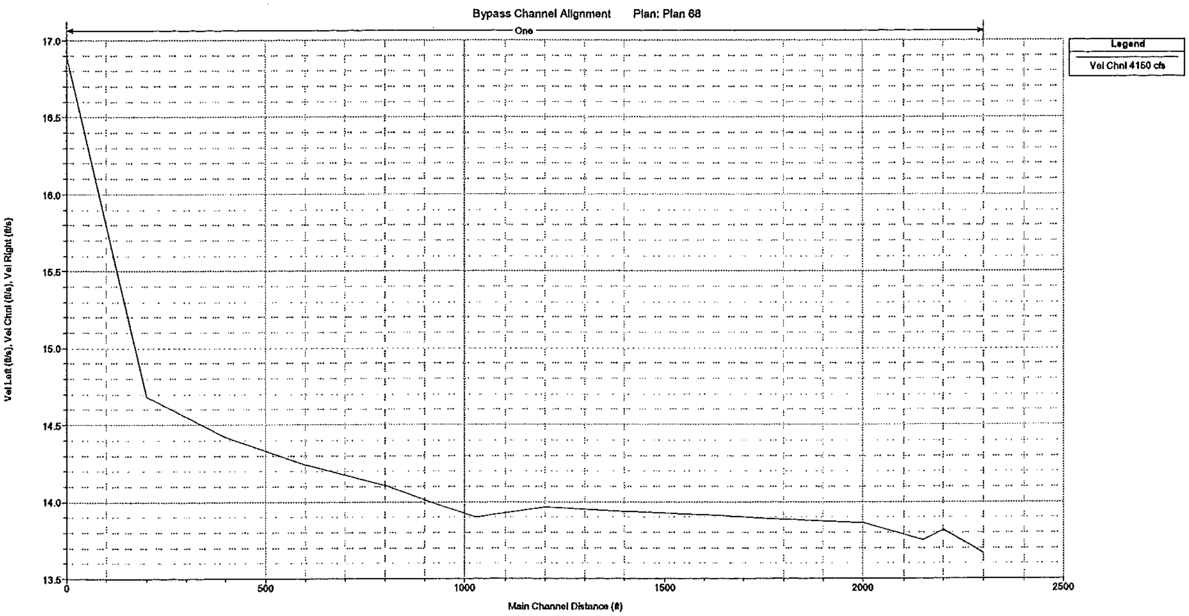


Figure 6.4: Velocities or Single Culvert Bypass Channel

Drop Structure and 45-degree Deflection Wall

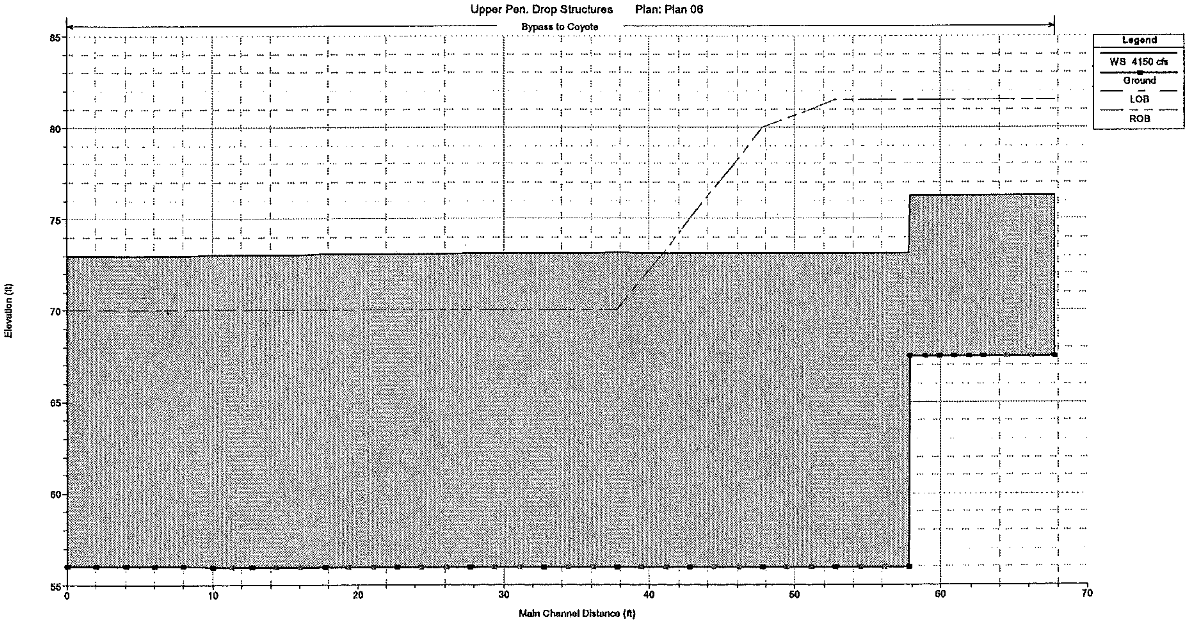


Figure 6.5: Water Surface Elevation for Single Culvert Bypass Channel

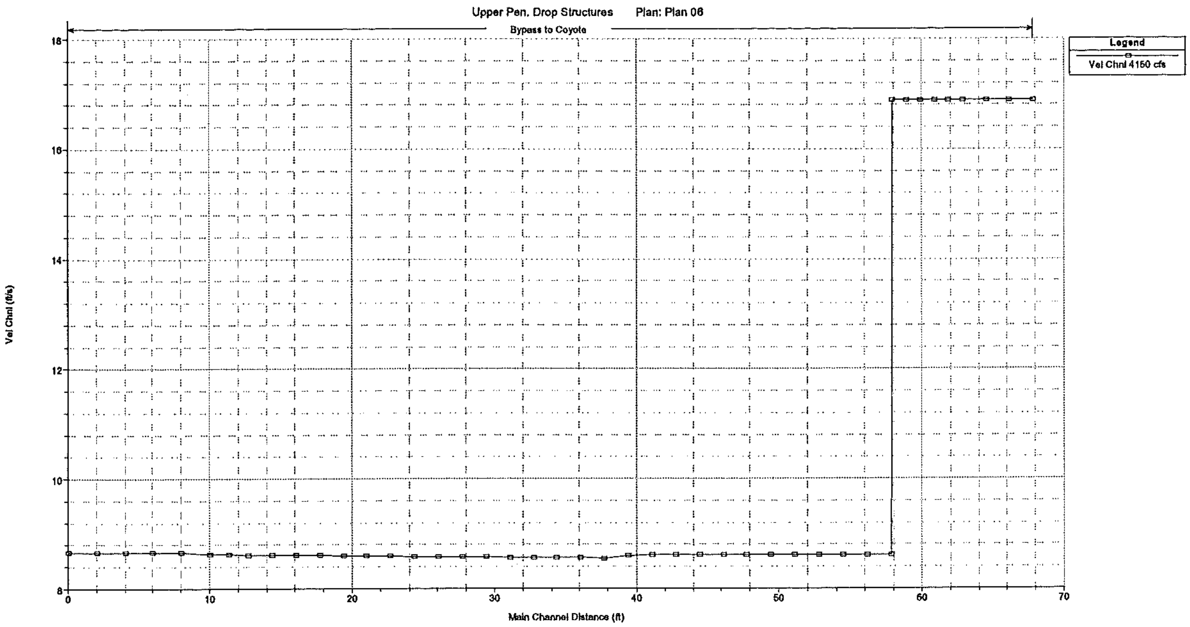


Figure 6.6: Velocities for Drop Structure

Recommendations

RECOMMENDATIONS

These recommendations address many of the concerns that were raised following the submittal of the HATM. The stand-alone lateral weir is a flow split structure is a non-operational flood control feature, as requested by SCVWD. The in-stream disturbance is minimized by not obstructing the path of flow. The PWA report indicates that a sediment problem does not currently exist in the vicinity of King Road so the predictability of the performance of the lateral weir is reliable. We recommend an initial detailed survey of the bottom of the natural channel along the lateral weir to insure proper performance of the weir. The performance of the lateral weir was designed to the existing natural bottom condition. Some maintenance will be required, but this alternative would not cause any additional maintenance than the other alternatives, perhaps requiring the least. For flows less than the 2-year event, no additional stresses are experienced by migrating steelhead. The probability of debris blockage is not worsened as in the with the in-line weir.

The recommended solution presented here supercedes the recommendations in the HATM and adequately address the concerns that were raised in the with the inflatable dam alternative. The single box culvert design was maintained and the outlet structure was realigned an analyzed to determine that a 45-degree alignment of the outlet would minimize destruction of SRA habitat and the merging of the flows would not cause excessive turbulence that would increase erosion along Coyote Creek banks.

Although the flow split is designed to handle the 100-year event, this design reflects existing UPC conditions. After 100-year flood protection is provided to the lower UPC watershed, the channel at UPC will most likely experience different conditions and the proposed bypass flow split may not operate as currently intended.

References

REFERENCES

Bell, Milo C. 1973. Fisheries Handbook of Engineering Requirements and Biological Criteria. Res. Prog. Corps of Engineers. North Pacific Division, Portland, Oregon.

Borghei, S.M.; Jalili, M.R.; Ghodsian, M. (1999). "Discharge Coefficient For Sharp-Crested Side Weir In Subcritical Flow." *Journal of Hydraulic Engineering, ASCE.* (125)10, 1051-1056.

Chaudhry, Hanif M. 1993. Open Channel Flow. Prentice Hall, Englewood Cliffs, New Jersey.

Chow, Ven Te. 1959. Open Channel Hydraulics. McGraw-Hill Book Company, New York.

Das, Amlan. (1997). "Spatially Varied Flow Over An Embankment Side Weir." *Journal of Hydraulic Engineering, ASCE.* (123)4. 314-317.

Gupta, R.S. (1989). *Hydrology and Hydraulic Systems.* Waveland Press, Prospect Heights, IL.

Federal Emergency Management Agency. 1986. Flood Insurance Study, Santa Clara County, California, Unincorporated Areas Volume 1 & 2. February 19, 1986.

HDR Engineering, Inc. "Upper Penitencia Creek Hydraulic Analysis Technical Memorandum." June 15, 2001. Prepared of Santa Clara Valley Water District.

Royston, Hanamoto, Beck & Abey. 1977. Master Plan Penitencia Creek Park.

Soil Conservation Serivce. 1990. Upper Penitencia Creek Watershed Final Watershed Plan and Environmental Impact Statement/Report. August 1990.

Street, Robert L., G.Z. Watters, and J.K. Vennard. 1996. Elementary Fluid Mechanics. John Wiley & Sons, Inc., New York.

US Army Corps of Engineers. 1993. River Hydraulics. EM 1110-2-1416, 15Oct93. Dept. of Army, Washington D.C.

US Army Corps of Engineers. 1991. Hydraulic Design of Flood Control Channels. EM 1110-2-1601, 1Jul91. Dept. of Army, Washington D.C.

US Army Corps of Engineers. 2001. HEC-RAS River Analysis System User's Manual Versions 3.0. Hydrologic Engineering Center, Davis California.

US Army Corps of Engineers. 2001. HEC-RAS River Analysis System Hydraulic Reference Manual Versions 3.0. Hydrologic Engineering Center, Davis California.

US Army Corps of Engineers. 2000. Upper Penitencia Creek Santa Clara County, California Hydrologic Engineering Office Report. July 2000.

US Army Corps of Engineers. 2000. Upper Penitencia Creek Initial Hydraulic Design Review. December 15, 2000.

US Army Corps of Engineers. 1995. Upper Penitencia Creek Flood Control Study Santa Clara County, California Reconnaissance Report. San Francisco District. July 1995.

Uyumaz, A. (1997). "Side Weir In U-Shaped Channels." *Journal of Hydraulic Engineering, ASCE*. (123)7. 649-646.

Drawings

Ultimate Condition. 4740 cfs

fixed bed.

interim Condition.

pavement end will
be the future widening
of Coyote Cr.
Continuous trail/maintenance
← 18' from edge of parking lot

EL. 67.5'
is the 2.5-yr @ Coyote
any higher Q would
inundate u/s.
Salmon gets in will die
Steelhead can turn around

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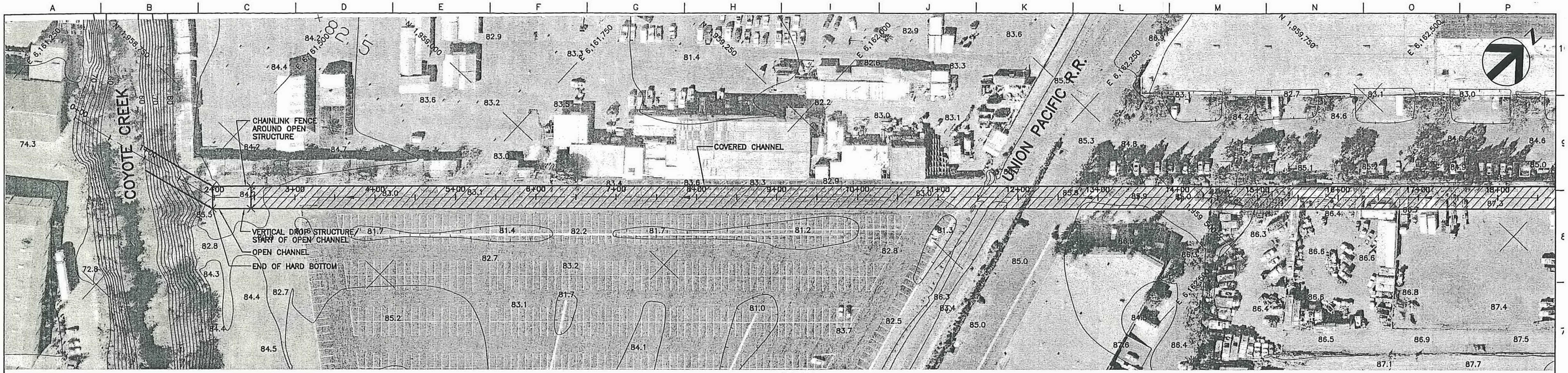

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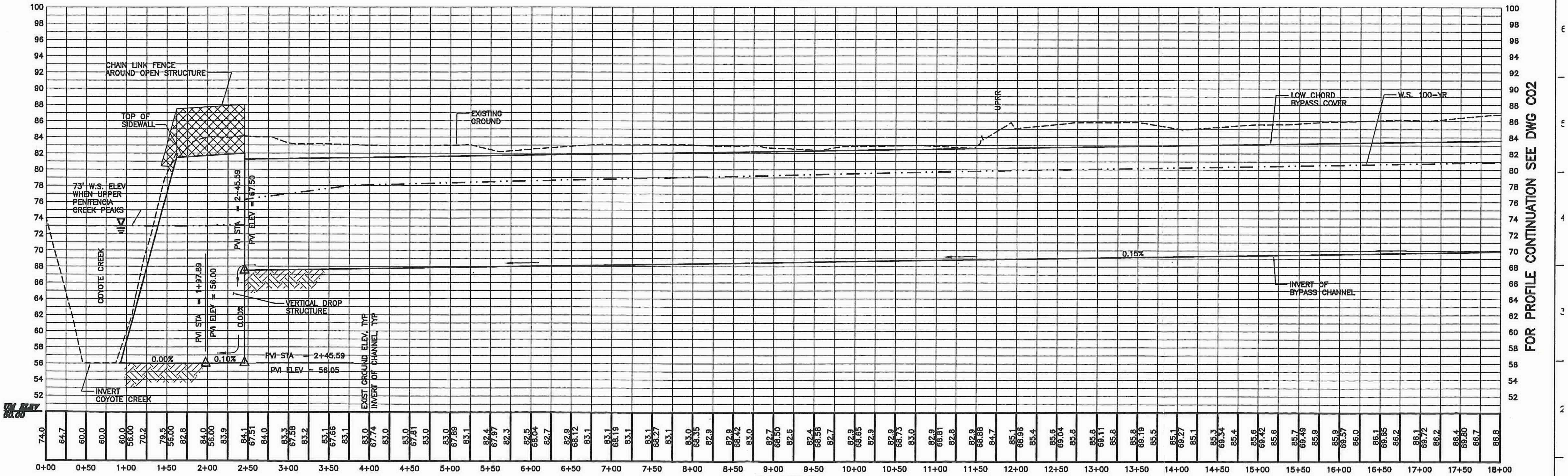

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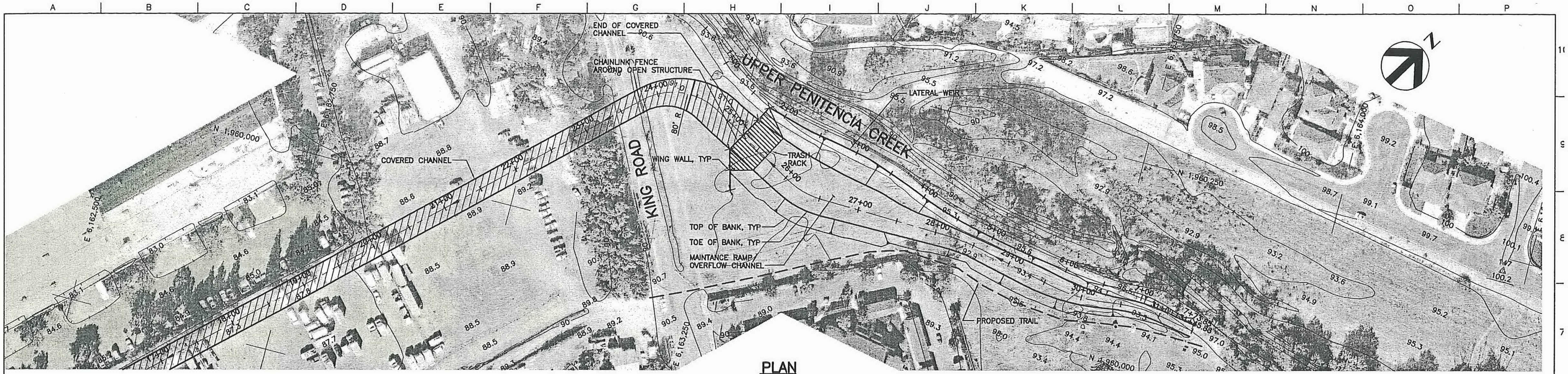

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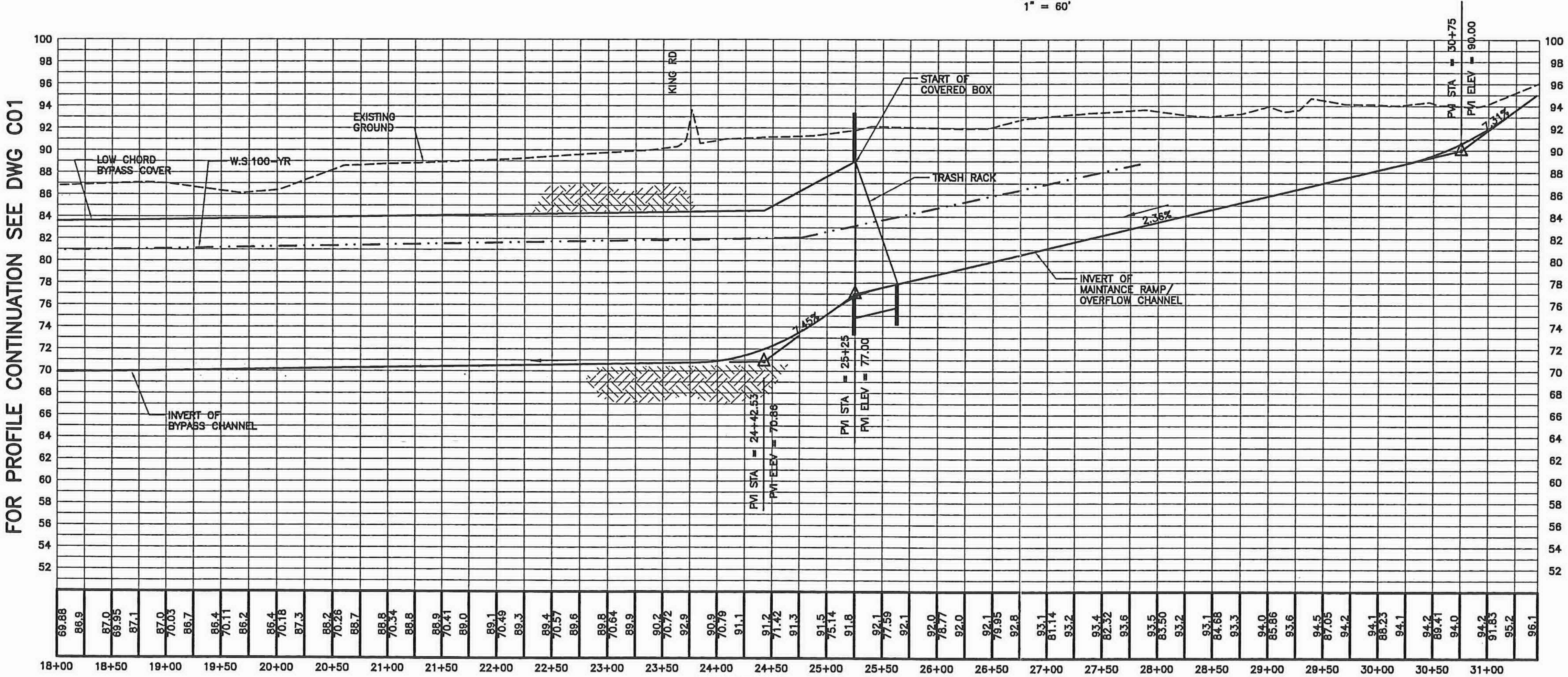

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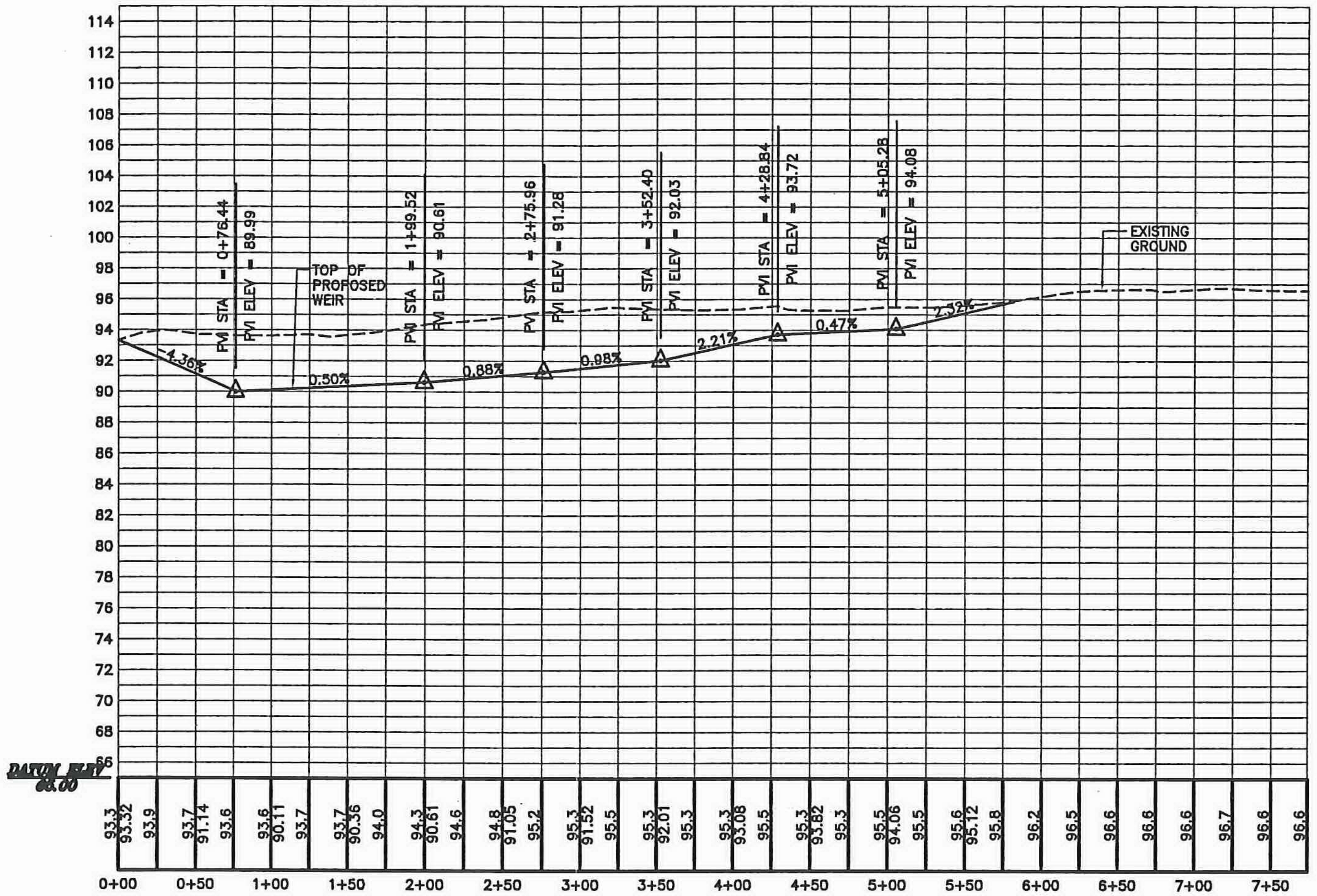

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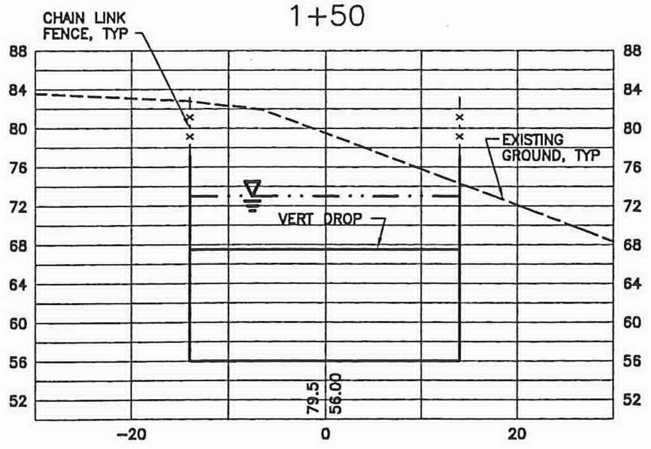

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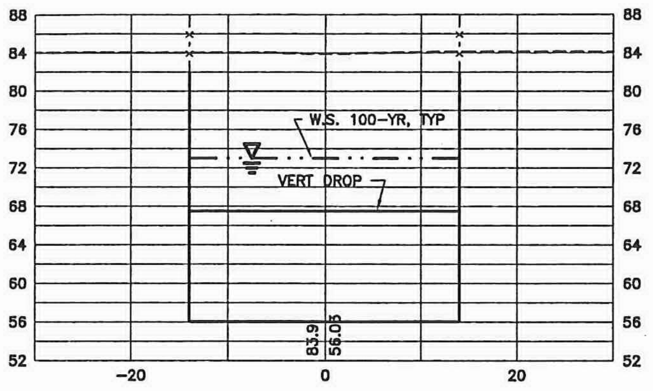

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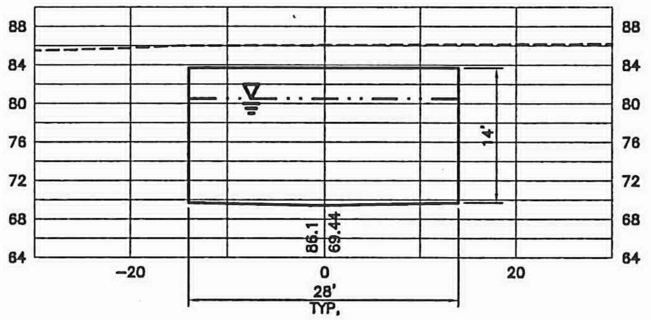

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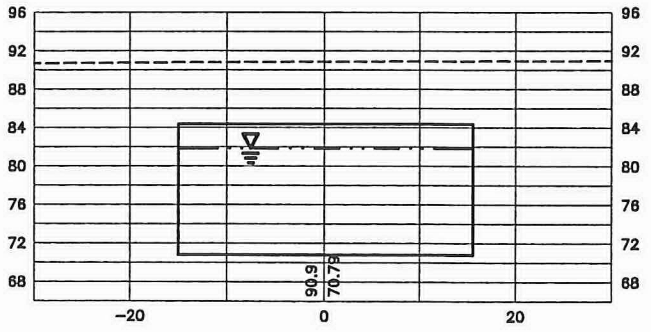

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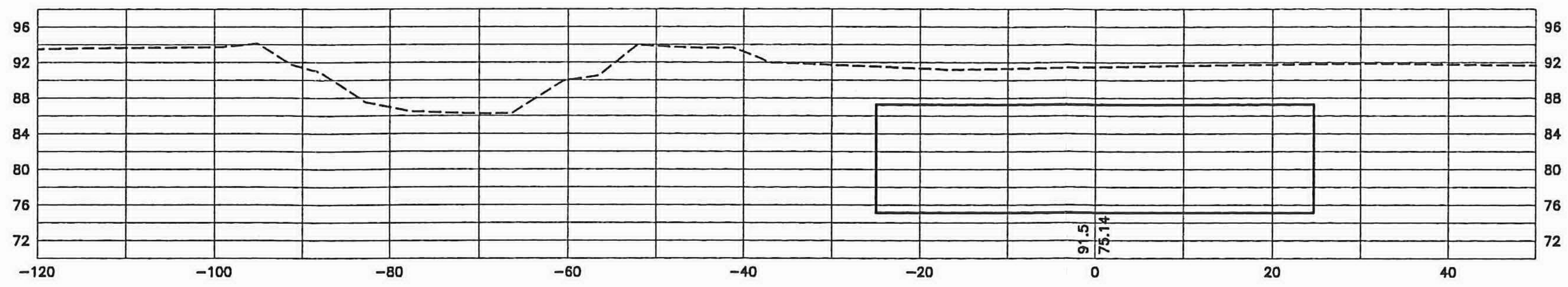

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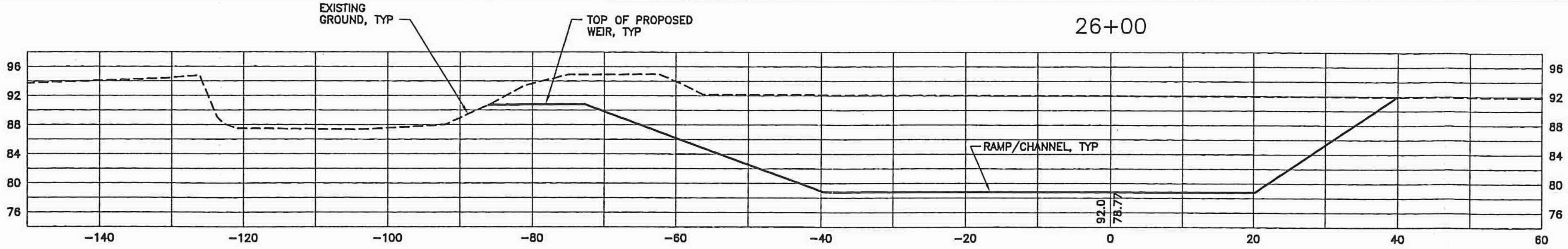

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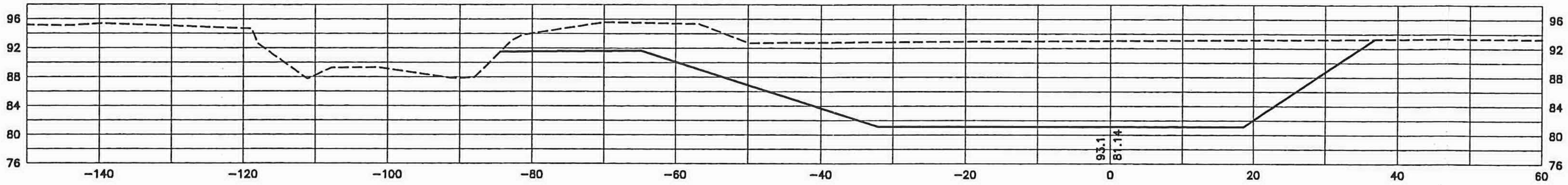

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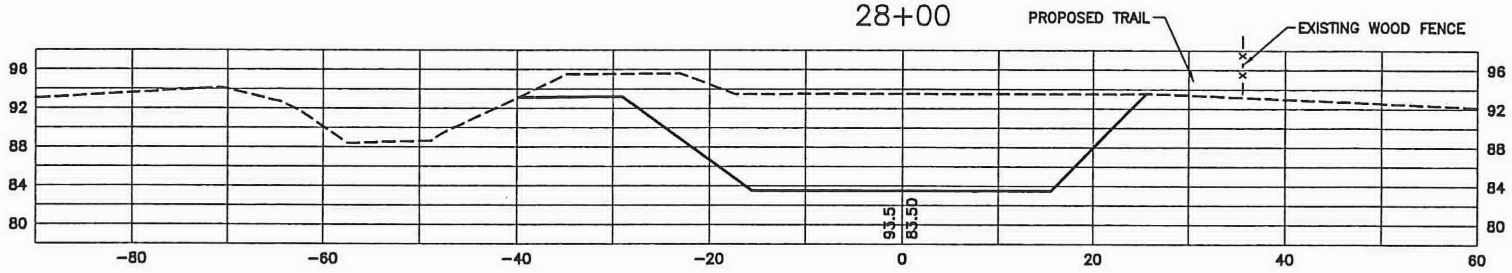

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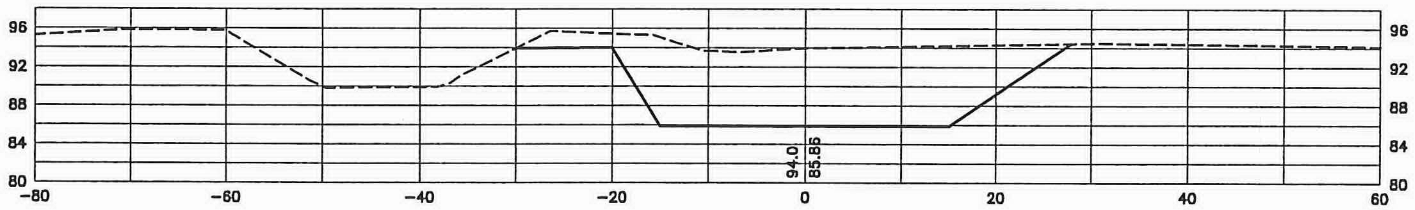

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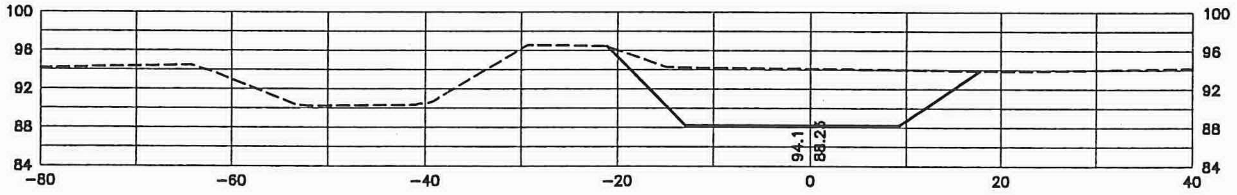

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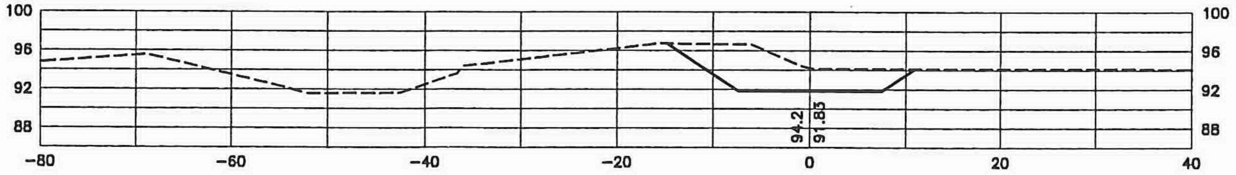

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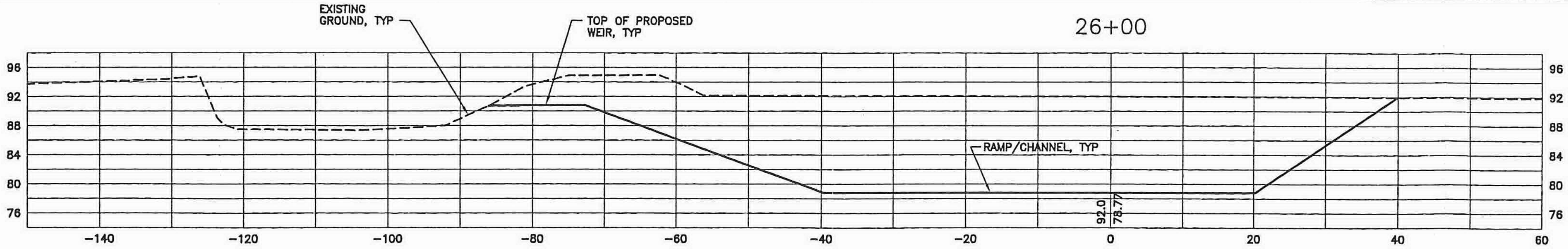

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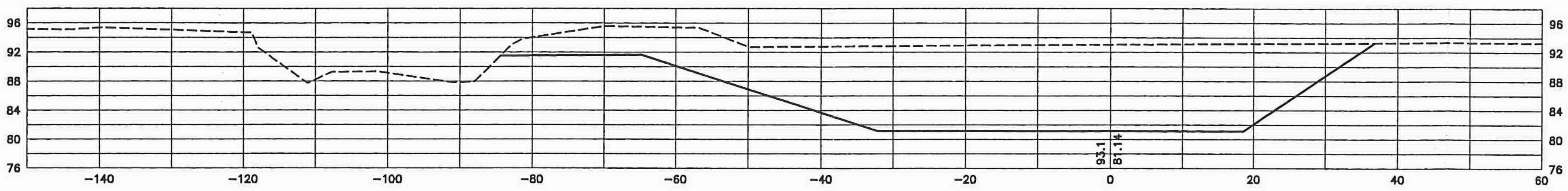

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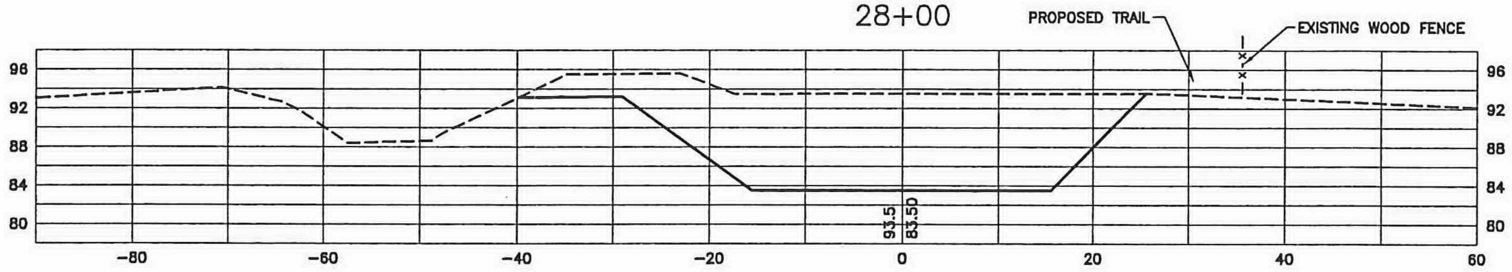

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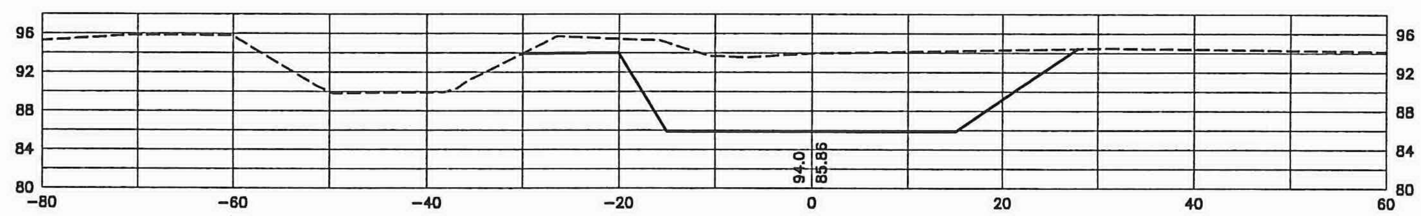

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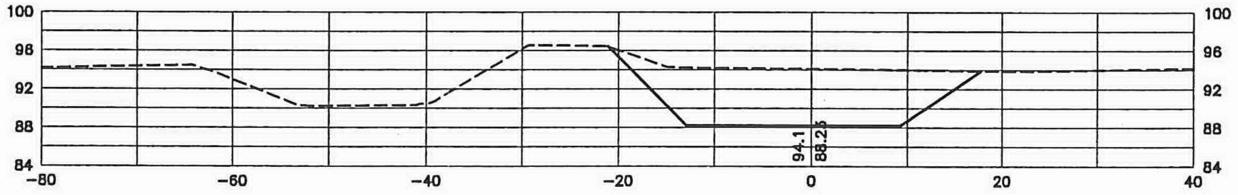

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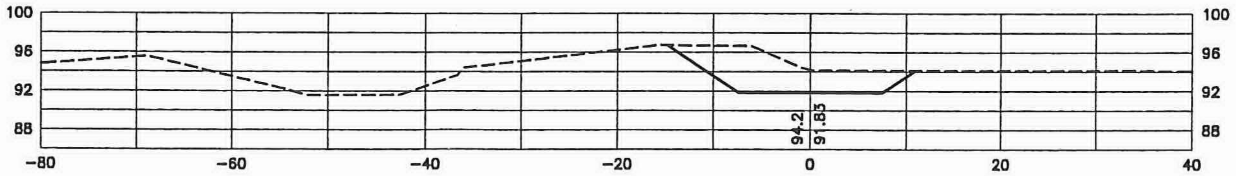

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Appendix

Coyote Creek Upper Manning's Range: Channel
n = 0.057/Overbank n = 0.114

HEC-RAS Plan: Plan 04 River: Coyote Creek Reach: one

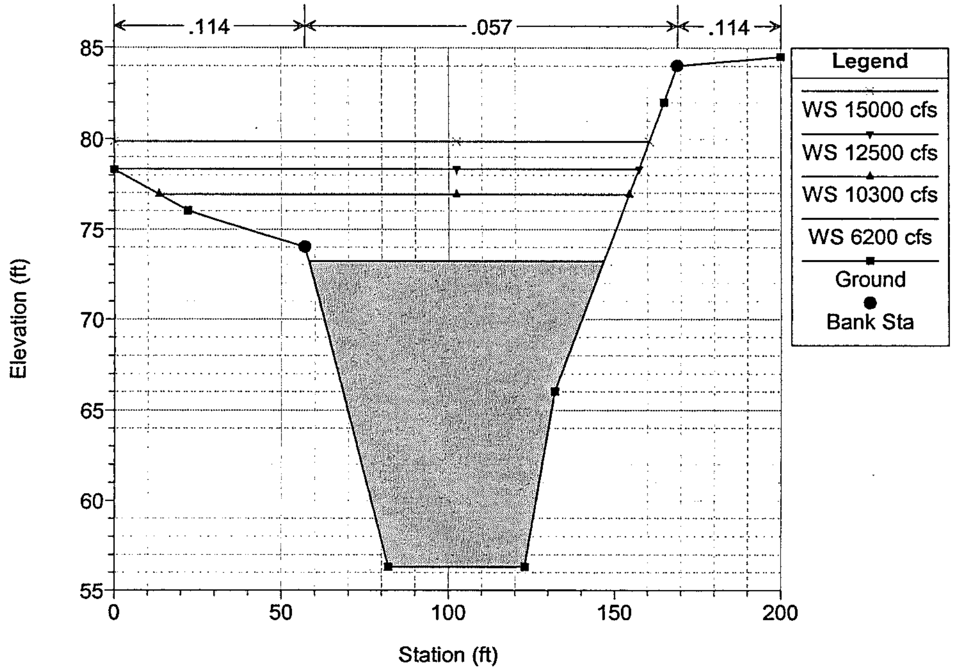
Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
one	800	6200.00	56.30	73.22		73.76	0.002173	5.86	1058.67	88.80	0.30
one	800	10300.00	56.30	76.90		77.72	0.002624	7.30	1473.37	141.12	0.34
one	800	12500.00	56.30	78.35		79.32	0.002858	7.96	1690.01	157.47	0.36
one	800	15000.00	56.30	79.85		80.96	0.003050	8.59	1927.94	160.56	0.37
one	750	6200.00	56.25	73.12		73.66	0.002200	5.87	1056.67	91.26	0.30
one	750	10300.00	56.25	76.77		77.59	0.002603	7.29	1466.93	137.44	0.34
one	750	12500.00	56.25	78.21		79.18	0.002834	7.97	1675.28	157.82	0.36
one	750	15000.00	56.25	79.69		80.81	0.003019	8.60	1917.11	164.70	0.38
one	700	6200.00	56.20	73.04		73.53	0.002190	5.62	1103.79	104.19	0.30
one	700	10300.00	56.20	76.73		77.43	0.002389	6.74	1596.69	161.41	0.33
one	700	12500.00	56.20	78.19		79.00	0.002500	7.28	1833.66	164.13	0.34
one	700	15000.00	56.20	79.69		80.61	0.002602	7.82	2081.88	166.93	0.35
one	650	6200.00	56.15	72.94		73.42	0.002051	5.57	1113.84	101.04	0.30
one	650	10300.00	56.15	76.60		77.31	0.002325	6.79	1592.92	164.06	0.33
one	650	12500.00	56.15	78.05		78.87	0.002475	7.36	1831.92	167.17	0.34
one	650	15000.00	56.15	79.54		80.48	0.002607	7.92	2083.36	170.38	0.35
one	600	6200.00	56.10	72.90		73.31	0.001616	5.14	1206.56	102.50	0.26
one	600	10300.00	56.10	76.55		77.18	0.001935	6.39	1692.96	165.99	0.30
one	600	12500.00	56.10	77.99		78.73	0.002097	6.97	1933.91	169.08	0.31
one	600	15000.00	56.10	79.48		80.33	0.002245	7.53	2187.36	172.27	0.33
one	550	6200.00	56.05	72.75		73.21	0.001937	5.45	1142.27	113.37	0.29
one	550	10300.00	56.05	76.40		77.08	0.002141	6.66	1648.17	153.57	0.31
one	550	12500.00	56.05	77.82		78.62	0.002306	7.26	1868.26	156.18	0.33
one	550	15000.00	56.05	79.28		80.21	0.002462	7.85	2098.85	158.87	0.34
one	500	6200.00	56.00	72.67		73.11	0.001928	5.28	1175.06	112.36	0.29
one	500	10300.00	56.00	76.33		76.95	0.002126	6.35	1668.60	161.53	0.31
one	500	12500.00	56.00	77.75		78.48	0.002252	6.89	1901.12	165.01	0.33
one	500	15000.00	56.00	79.22		80.06	0.002366	7.42	2146.21	168.59	0.34
one	450	6200.00	55.95	72.49		73.00	0.002076	5.70	1087.13	94.43	0.30
one	450	10300.00	55.95	76.03		76.82	0.002532	7.14	1483.38	143.66	0.34
one	450	12500.00	55.95	77.39		78.34	0.002783	7.84	1680.58	146.24	0.36
one	450	15000.00	55.95	78.79		79.90	0.003018	8.52	1887.58	148.91	0.38
one	400	6200.00	55.90	72.45		72.88	0.001815	5.28	1174.16	105.59	0.28
one	400	10300.00	55.90	76.00		76.66	0.002128	6.54	1618.28	139.51	0.31
one	400	12500.00	55.90	77.37		78.16	0.002324	7.18	1810.32	141.90	0.33
one	400	15000.00	55.90	78.77		79.71	0.002515	7.82	2011.39	144.35	0.35
one	350	6200.00	55.85	72.03		72.73	0.003342	6.71	923.44	90.33	0.37
one	350	10300.00	55.85	75.46		76.49	0.003841	8.15	1314.09	140.93	0.41
one	350	12500.00	55.85	76.77		77.97	0.004107	8.86	1499.40	143.53	0.43
one	350	15000.00	55.85	78.12		79.50	0.004346	9.56	1694.81	146.23	0.45
one	300	6200.00	55.80	71.60		72.52	0.004376	7.68	807.45	75.75	0.41
one	300	10300.00	55.80	74.77		76.21	0.005716	9.65	1099.53	133.50	0.48
one	300	12500.00	55.80	75.94		77.66	0.006460	10.59	1259.66	140.84	0.52
one	300	15000.00	55.80	77.18		79.17	0.006905	11.45	1442.02	148.35	0.54
one	250	6200.00	55.75	71.39		72.30	0.004349	7.65	810.79	77.67	0.42
one	250	10300.00	55.75	74.51		75.93	0.005448	9.58	1132.96	143.95	0.48
one	250	12500.00	55.75	75.66		77.35	0.006003	10.51	1299.93	145.97	0.51
one	250	15000.00	55.75	76.87		78.82	0.006481	11.39	1477.42	148.09	0.53
one	200	6200.00	55.70	71.08		72.07	0.004531	7.98	799.47	111.17	0.42
one	200	10300.00	55.70	74.14		75.64	0.005638	9.98	1148.88	117.28	0.49
one	200	12500.00	55.70	75.19		77.02	0.006497	11.08	1272.54	119.37	0.53
one	200	15000.00	55.70	76.24		78.45	0.007395	12.21	1399.90	121.49	0.57
one	150	6200.00	55.65	71.01		71.82	0.003442	7.21	880.31	105.92	0.37
one	150	10300.00	55.65	74.03		75.33	0.004565	9.26	1207.58	111.31	0.44
one	150	12500.00	55.65	75.03		76.66	0.005390	10.39	1320.55	113.11	0.48
one	150	15000.00	55.65	76.04		78.05	0.006289	11.57	1435.57	114.92	0.52
one	130	6200.00	55.60	71.00	63.99	71.74	0.003140	6.91	911.55	103.80	0.36
one	130	10300.00	55.60	74.00	66.95	75.22	0.004189	8.92	1231.05	109.20	0.42

HEC-RAS Plan: Plan 04 River: Coyote Creek Reach: one (Continued)

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
one	130	12500.00	55.60	75.00	68.31	76.53	0.004963	10.03	1341.15	111.00	0.46
one	130	15000.00	55.60	76.00	69.70	77.89	0.005812	11.19	1453.05	112.80	0.51

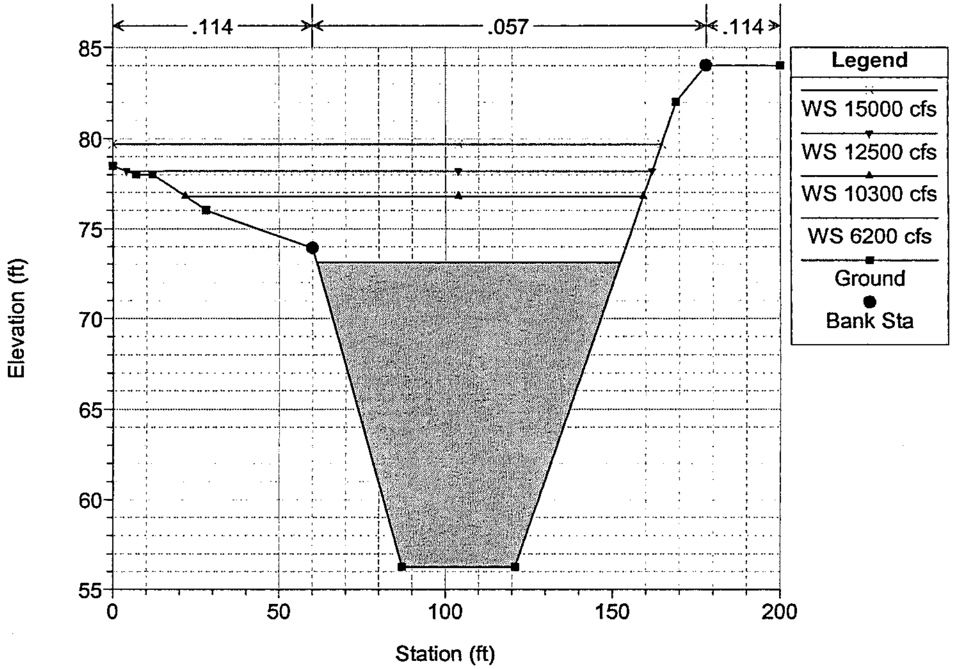
Coyote Creek At Bypass Outlet Plan: Plan 09

River = Coyote Creek Reach = one RS = 800



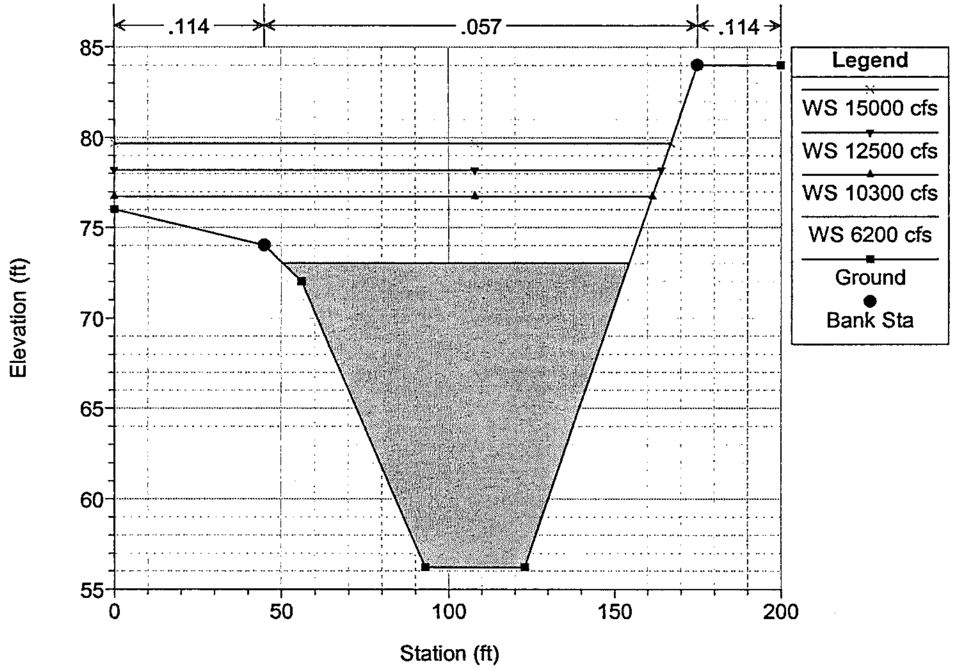
Coyote Creek At Bypass Outlet Plan: Plan 09

River = Coyote Creek Reach = one RS = 750



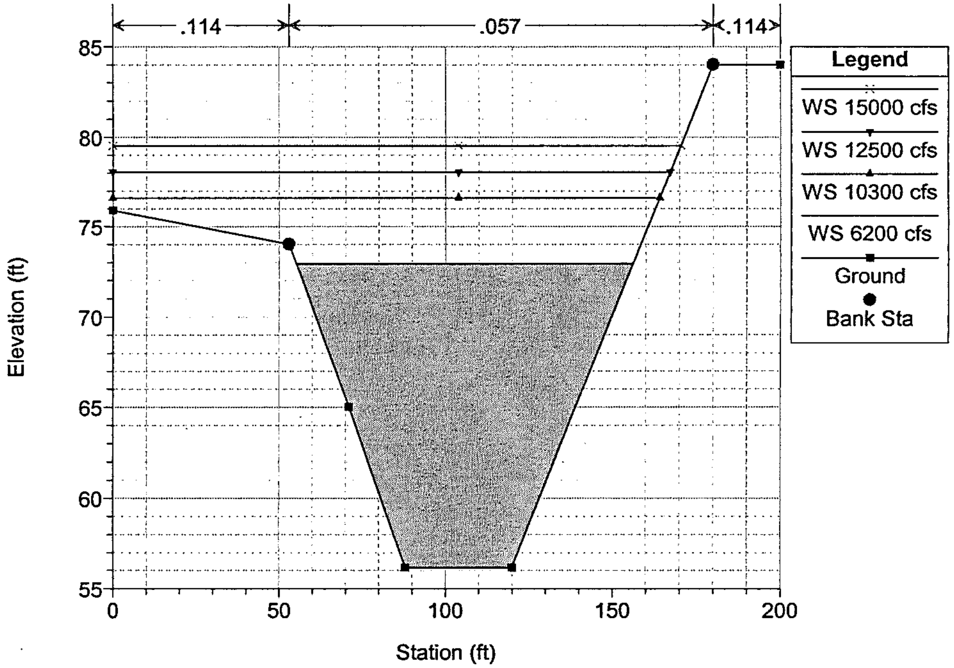
Coyote Creek At Bypass Outlet Plan: Plan 09

River = Coyote Creek Reach = one RS = 700

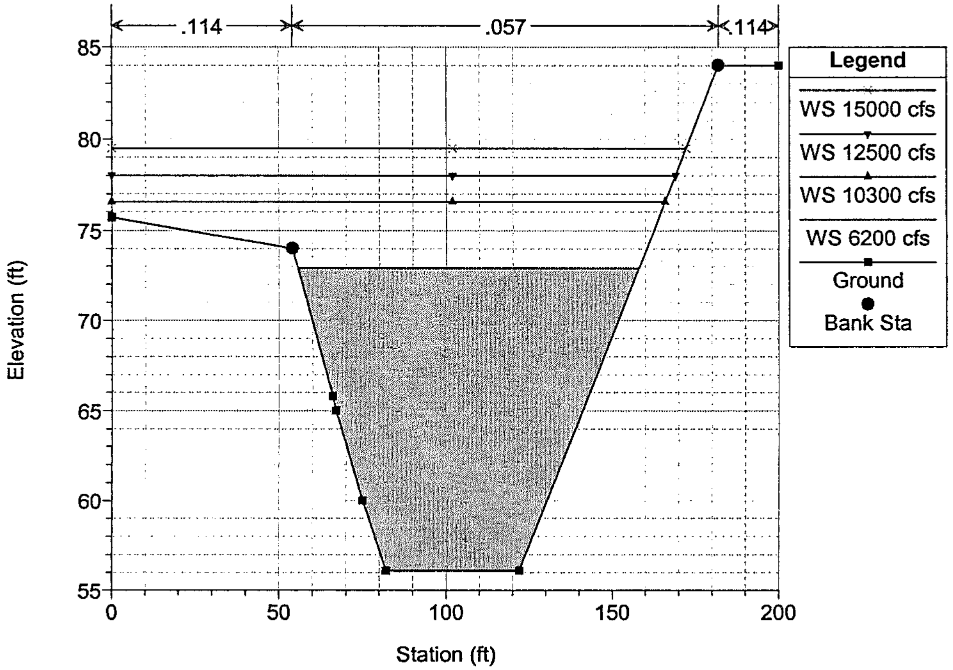


Coyote Creek At Bypass Outlet Plan: Plan 09

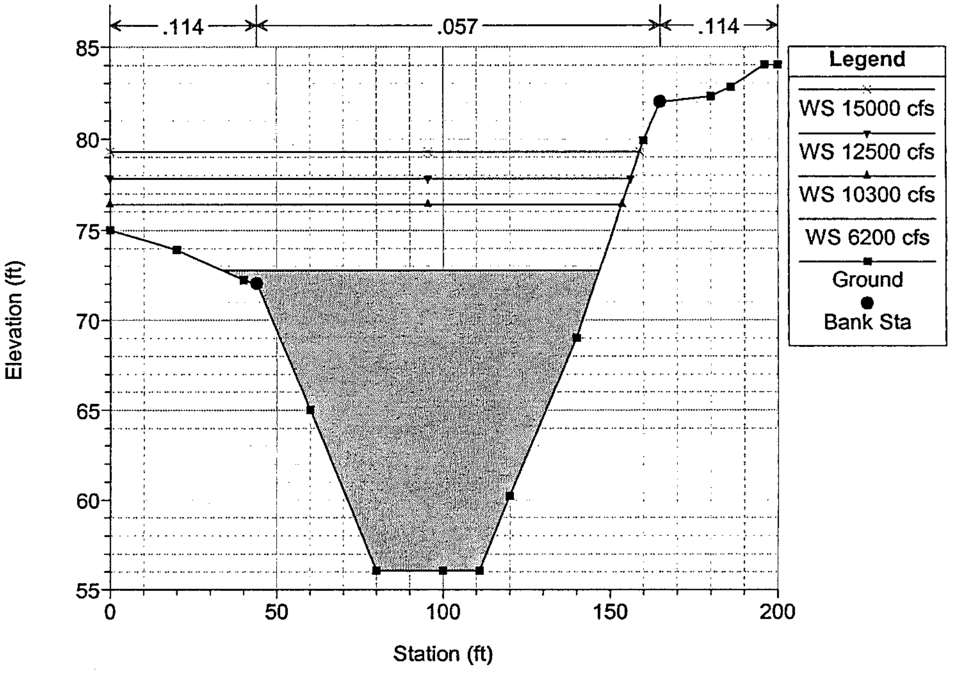
River = Coyote Creek Reach = one RS = 650



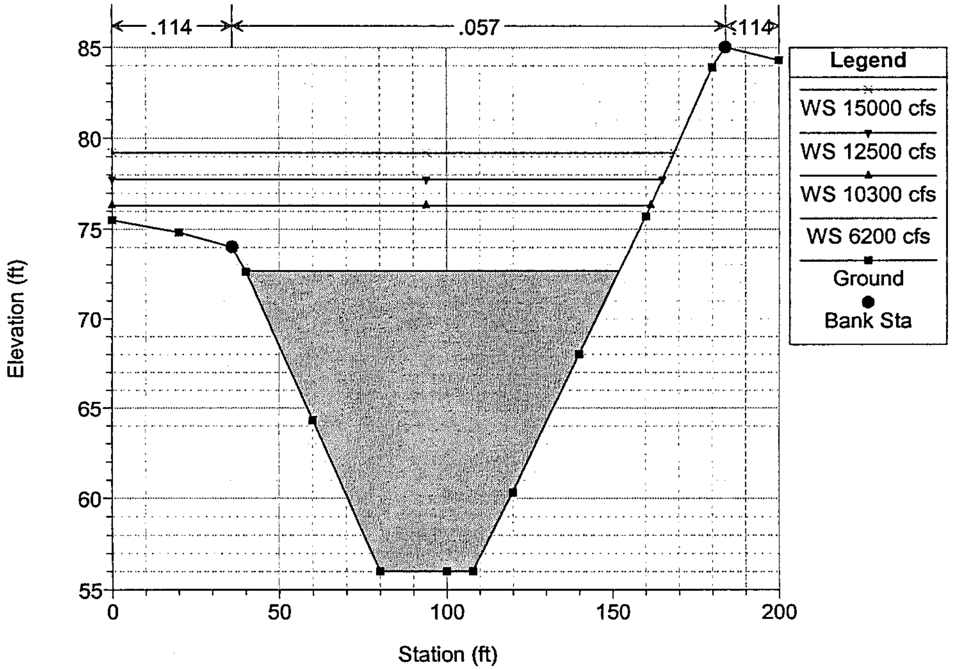
Coyote Creek At Bypass Outlet Plan: Plan 09
River = Coyote Creek Reach = one RS = 600



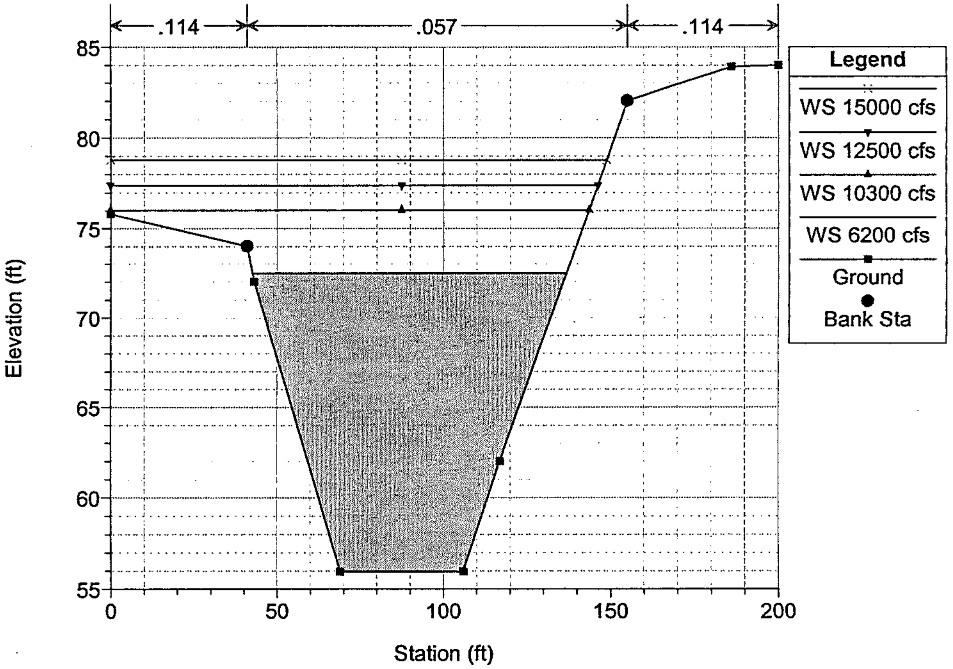
Coyote Creek At Bypass Outlet Plan: Plan 09
River = Coyote Creek Reach = one RS = 550

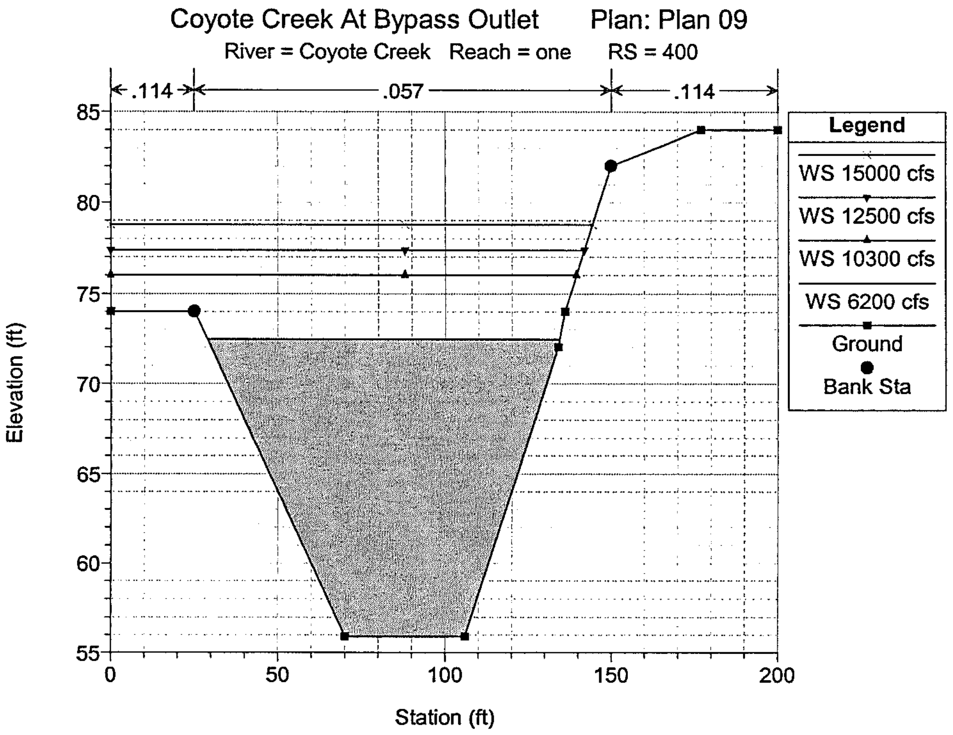


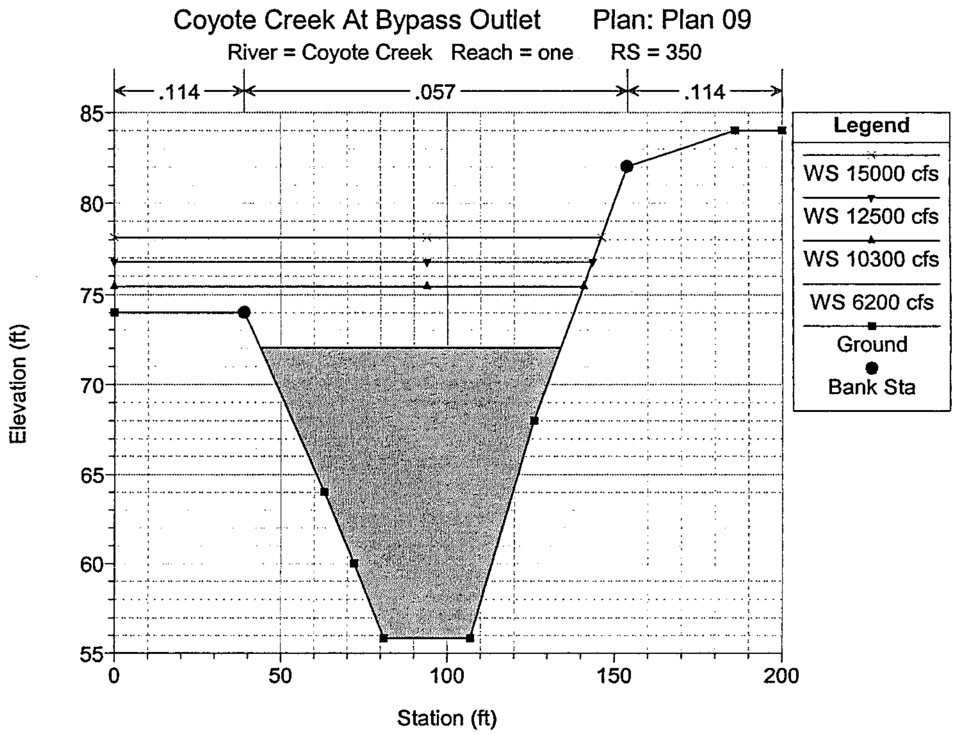
Coyote Creek At Bypass Outlet Plan: Plan 09
River = Coyote Creek Reach = one RS = 500

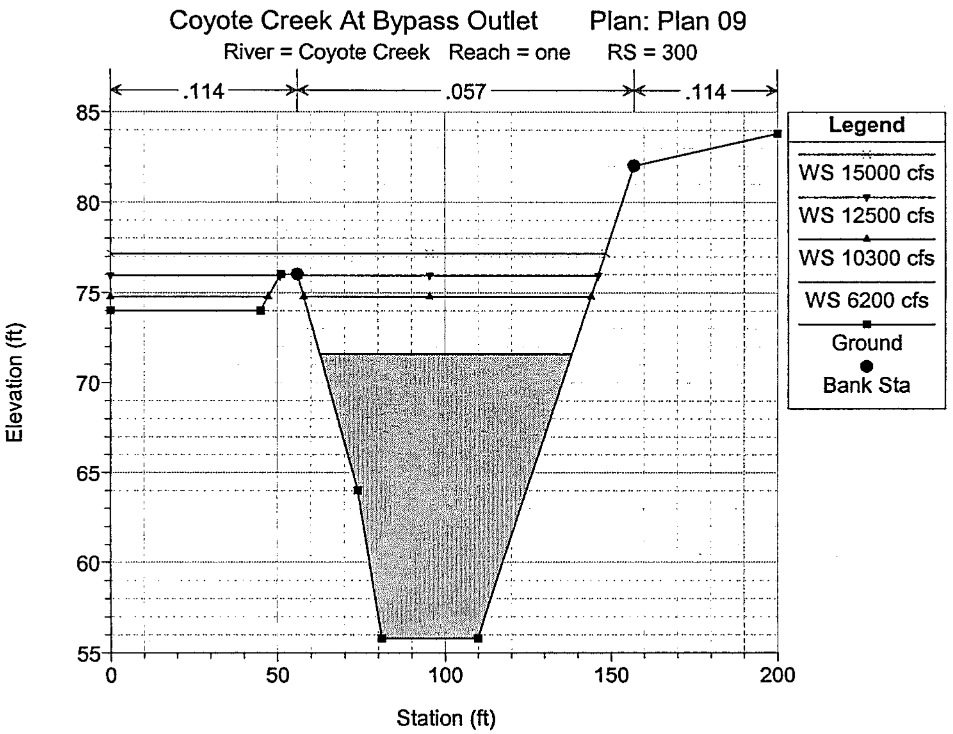


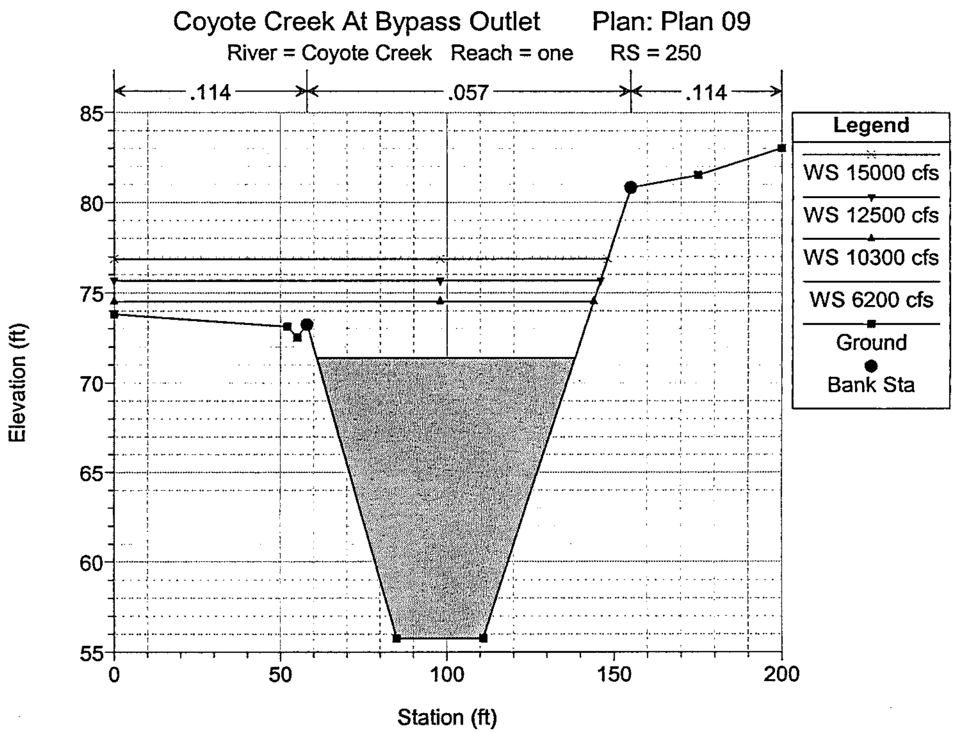
Coyote Creek At Bypass Outlet Plan: Plan 09
River = Coyote Creek Reach = one RS = 450

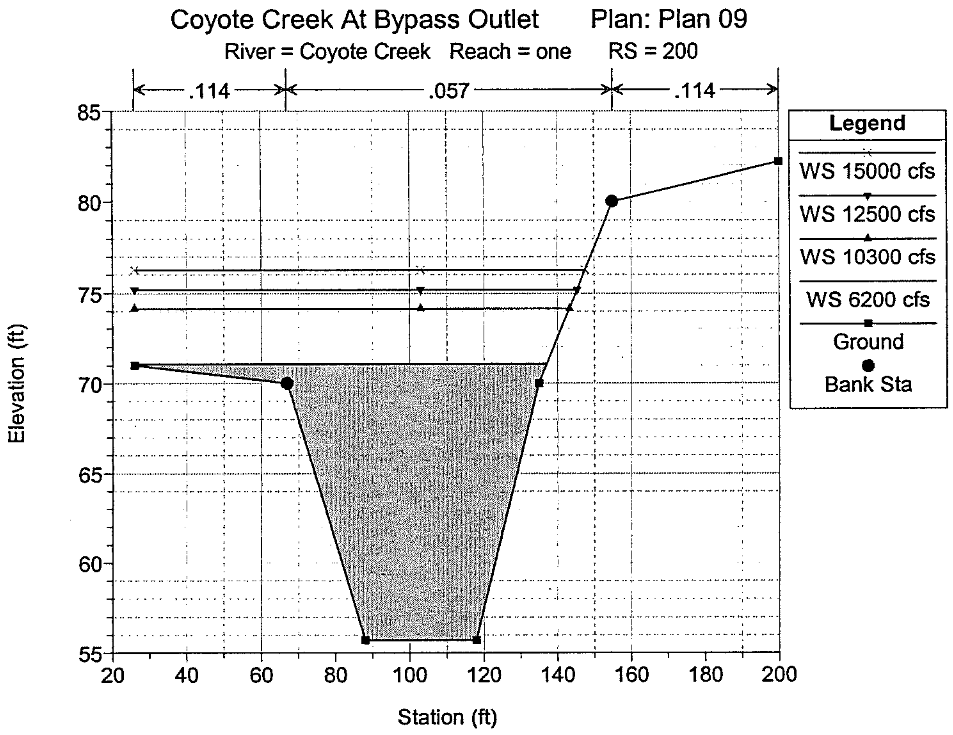


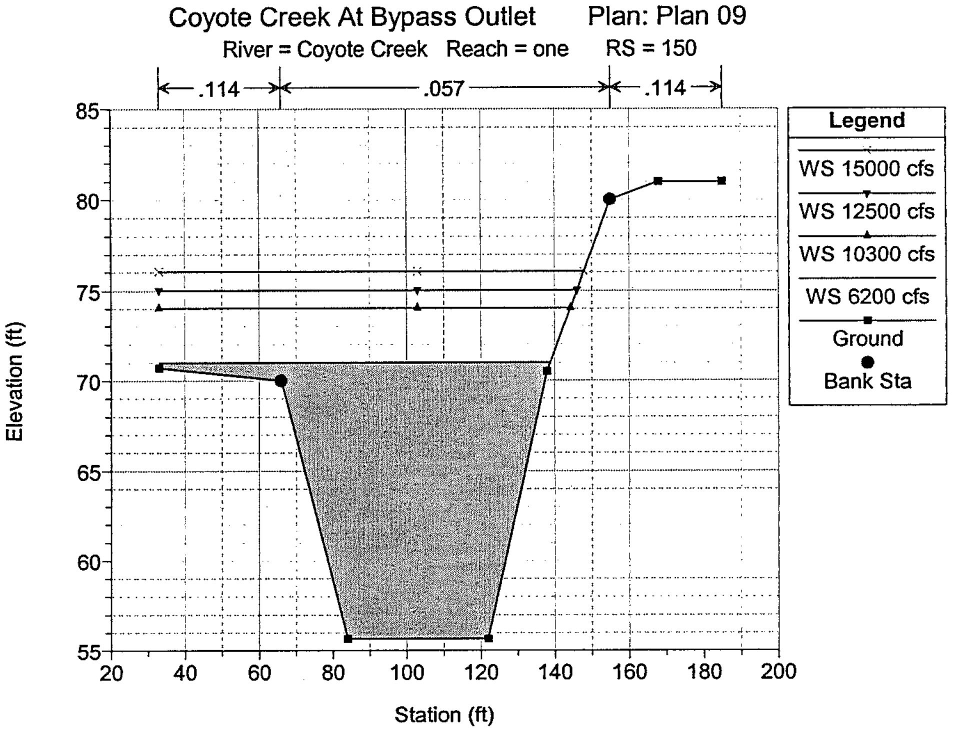

Coyote Creek At Bypass Outlet Plan: Plan 09
River = Coyote Creek Reach = one RS = 400
.114
.057
.114
Legend
WS 15000 cfs
WS 12500 cfs
WS 10300 cfs
WS 6200 cfs
Ground
Bank Sta
Elevation (ft)
85
80
75
70
65
60
55
0
50
100
150
200
Station (ft)

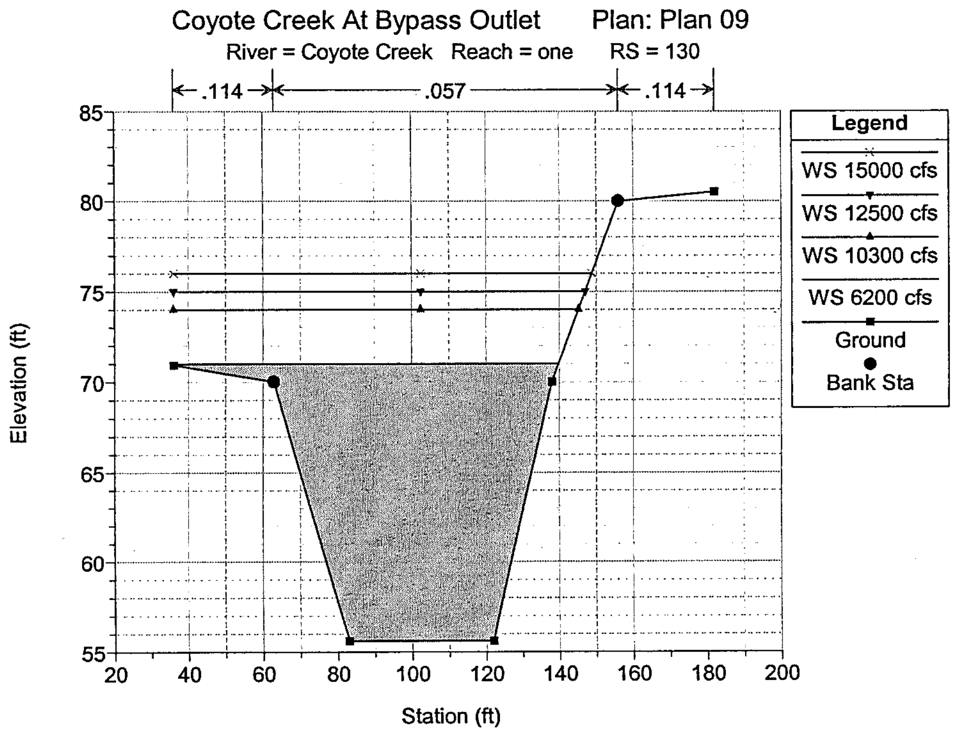

Coyote Creek At Bypass Outlet Plan: Plan 09
River = Coyote Creek Reach = one RS = 350
.114
.057
.114
Legend
WS 15000 cfs
WS 12500 cfs
WS 10300 cfs
WS 6200 cfs
Ground
Bank Sta
Elevation (ft)
85
80
75
70
65
60
55
0
50
100
150
200
Station (ft)


Coyote Creek At Bypass Outlet Plan: Plan 09
River = Coyote Creek Reach = one RS = 300
.114
.057
.114
Legend
WS 15000 cfs
WS 12500 cfs
WS 10300 cfs
WS 6200 cfs
Ground
Bank Sta
Elevation (ft)
85
80
75
70
65
60
55
0
50
100
150
200
Station (ft)


Coyote Creek At Bypass Outlet Plan: Plan 09
River = Coyote Creek Reach = one RS = 250
.114
.057
.114
Legend
WS 15000 cfs
WS 12500 cfs
WS 10300 cfs
WS 6200 cfs
Ground
Bank Sta
Elevation (ft)
85
80
75
70
65
60
55
0
50
100
150
200
Station (ft)


Coyote Creek At Bypass Outlet Plan: Plan 09
River = Coyote Creek Reach = one RS = 200
.114
.057
.114
Legend
WS 15000 cfs
WS 12500 cfs
WS 10300 cfs
WS 6200 cfs
Ground
Bank Sta
Elevation (ft)
85
80
75
70
65
60
55
20
40
60
80
100
120
140
160
180
200
Station (ft)


Coyote Creek At Bypass Outlet Plan: Plan 09
River = Coyote Creek Reach = one RS = 150
.114
.057
.114
Legend
WS 15000 cfs
WS 12500 cfs
WS 10300 cfs
WS 6200 cfs
Ground
Bank Sta
Elevation (ft)
85
80
75
70
65
60
55
20
40
60
80
100
120
140
160
180
200
Station (ft)


Coyote Creek At Bypass Outlet Plan: Plan 09
River = Coyote Creek Reach = one RS = 130
.114
.057
.114
Legend
WS 15000 cfs
WS 12500 cfs
WS 10300 cfs
WS 6200 cfs
Ground
Bank Sta
Elevation (ft)
85
80
75
70
65
60
55
20
40
60
80
100
120
140
160
180
200
Station (ft)

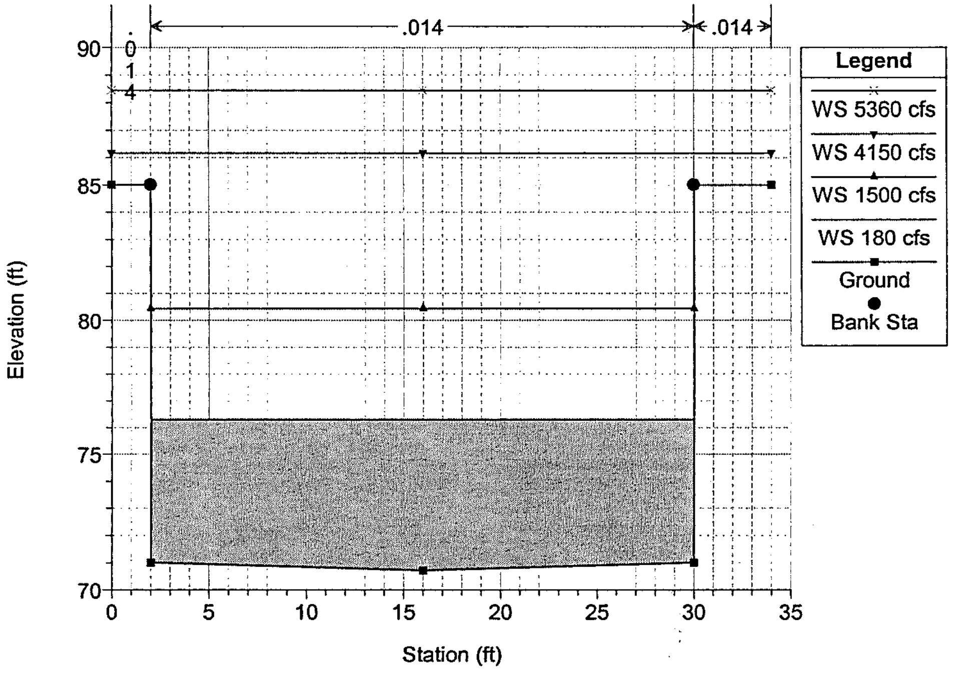
Coyote Creek Lower Manning's Range: Channel n = 0.036/Overbank n = 0.04

HEC-RAS Plan: Plan 04 River: Coyote Creek Reach: one

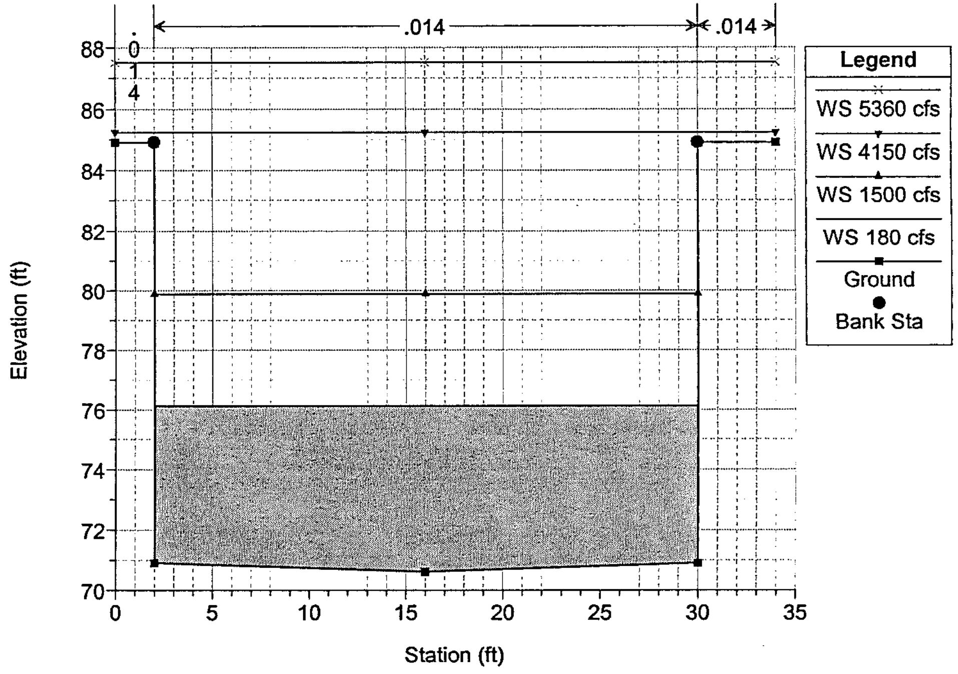
Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
one	800	6200.00	56.30	72.19		72.83	0.001100	6.40	969.07	85.23	0.33
one	800	10300.00	56.30	75.60		76.60	0.001390	8.04	1299.53	122.72	0.39
one	800	12500.00	56.30	76.90		78.09	0.001528	8.81	1472.64	141.06	0.41
one	800	15000.00	56.30	78.18		79.57	0.001662	9.57	1663.79	156.02	0.43
one	750	6200.00	56.25	72.14		72.78	0.001113	6.40	968.62	87.92	0.34
one	750	10300.00	56.25	75.53		76.53	0.001367	8.00	1305.07	121.86	0.39
one	750	12500.00	56.25	76.83		78.01	0.001497	8.77	1474.77	138.00	0.41
one	750	15000.00	56.25	78.10		79.49	0.001633	9.55	1658.95	156.17	0.43
one	700	6200.00	56.20	72.11		72.70	0.001073	6.13	1010.82	97.39	0.34
one	700	10300.00	56.20	75.57		76.42	0.001274	7.42	1411.79	149.46	0.38
one	700	12500.00	56.20	76.90		77.88	0.001332	8.01	1623.36	161.72	0.39
one	700	15000.00	56.20	78.21		79.34	0.001392	8.61	1837.82	164.18	0.40
one	650	6200.00	56.15	72.08		72.64	0.001016	6.03	1028.39	97.46	0.33
one	650	10300.00	56.15	75.51		76.36	0.001200	7.41	1416.40	150.68	0.37
one	650	12500.00	56.15	76.83		77.82	0.001278	8.04	1630.33	164.55	0.38
one	650	15000.00	56.15	78.14		79.27	0.001352	8.64	1848.10	167.38	0.40
one	600	6200.00	56.10	72.10		72.57	0.000780	5.51	1125.82	99.62	0.29
one	600	10300.00	56.10	75.53		76.27	0.000967	6.90	1524.79	158.42	0.33
one	600	12500.00	56.10	76.86		77.72	0.001048	7.52	1743.61	166.64	0.35
one	600	15000.00	56.10	78.17		79.17	0.001128	8.13	1964.13	169.46	0.36
one	550	6200.00	56.05	71.99		72.52	0.000960	5.85	1059.74	101.45	0.32
one	550	10300.00	56.05	75.43		76.21	0.001059	7.15	1500.34	151.80	0.35
one	550	12500.00	56.05	76.75		77.66	0.001131	7.76	1702.97	154.23	0.36
one	550	15000.00	56.05	78.05		79.10	0.001213	8.40	1904.53	156.61	0.38
one	500	6200.00	56.00	71.96		72.46	0.000927	5.65	1096.51	108.76	0.31
one	500	10300.00	56.00	75.41		76.14	0.001060	6.85	1522.20	156.83	0.35
one	500	12500.00	56.00	76.74		77.59	0.001122	7.42	1735.40	162.54	0.36
one	500	15000.00	56.00	78.04		79.02	0.001191	8.01	1948.95	165.71	0.38
one	450	6200.00	55.95	71.84		72.41	0.000974	6.04	1025.82	92.43	0.32
one	450	10300.00	55.95	75.17		76.07	0.001224	7.62	1364.59	127.58	0.37
one	450	12500.00	55.95	76.42		77.50	0.001355	8.39	1539.39	144.40	0.39
one	450	15000.00	55.95	77.65		78.92	0.001488	9.15	1718.10	146.73	0.41
one	400	6200.00	55.90	71.85		72.33	0.000843	5.58	1111.88	103.40	0.30
one	400	10300.00	55.90	75.22		75.96	0.001015	6.94	1509.43	138.13	0.34
one	400	12500.00	55.90	76.49		77.38	0.001110	7.62	1686.29	140.36	0.36
one	400	15000.00	55.90	77.73		78.79	0.001219	8.33	1861.25	142.52	0.38
one	350	6200.00	55.85	71.47		72.25	0.001547	7.10	873.30	87.85	0.40
one	350	10300.00	55.85	74.68		75.85	0.001875	8.72	1203.79	139.35	0.45
one	350	12500.00	55.85	75.88		77.26	0.002004	9.48	1373.61	141.77	0.47
one	350	15000.00	55.85	77.06		78.66	0.002147	10.25	1541.98	144.12	0.49
one	300	6200.00	55.80	71.14		72.14	0.001964	8.02	772.91	74.23	0.44
one	300	10300.00	55.80	74.06		75.69	0.002683	10.26	1006.18	129.02	0.52
one	300	12500.00	55.80	75.08		77.07	0.003108	11.37	1140.65	135.42	0.57
one	300	15000.00	55.80	76.09		78.45	0.003511	12.43	1282.36	146.41	0.61
one	250	6200.00	55.75	71.07		72.03	0.001888	7.89	785.82	76.61	0.43
one	250	10300.00	55.75	74.00		75.55	0.002474	10.01	1059.21	143.05	0.51
one	250	12500.00	55.75	75.02		76.87	0.002759	11.02	1206.67	144.85	0.54
one	250	15000.00	55.75	76.08		78.22	0.003004	11.95	1361.36	146.71	0.57
one	200	6200.00	55.70	70.92		71.93	0.001886	8.09	781.49	107.57	0.43
one	200	10300.00	55.70	73.94		75.40	0.002252	9.91	1125.45	116.88	0.49
one	200	12500.00	55.70	74.95		76.71	0.002568	10.95	1244.43	118.90	0.52
one	200	15000.00	55.70	75.97		78.06	0.002899	12.01	1366.20	120.93	0.56
one	150	6200.00	55.65	70.99		71.79	0.001378	7.21	877.46	105.87	0.37
one	150	10300.00	55.65	73.98		75.23	0.001775	9.13	1202.30	111.23	0.43
one	150	12500.00	55.65	74.98		76.52	0.002073	10.19	1314.58	113.02	0.47
one	150	15000.00	55.65	75.98		77.86	0.002395	11.29	1428.87	114.81	0.51
one	130	6200.00	55.60	71.00	63.99	71.74	0.001250	6.90	911.55	103.80	0.36
one	130	10300.00	55.60	74.00	66.95	75.17	0.001627	8.80	1231.05	109.20	0.42

HEC-RAS Plan: Plan 04 River: Coyote Creek Reach: one (Continued)

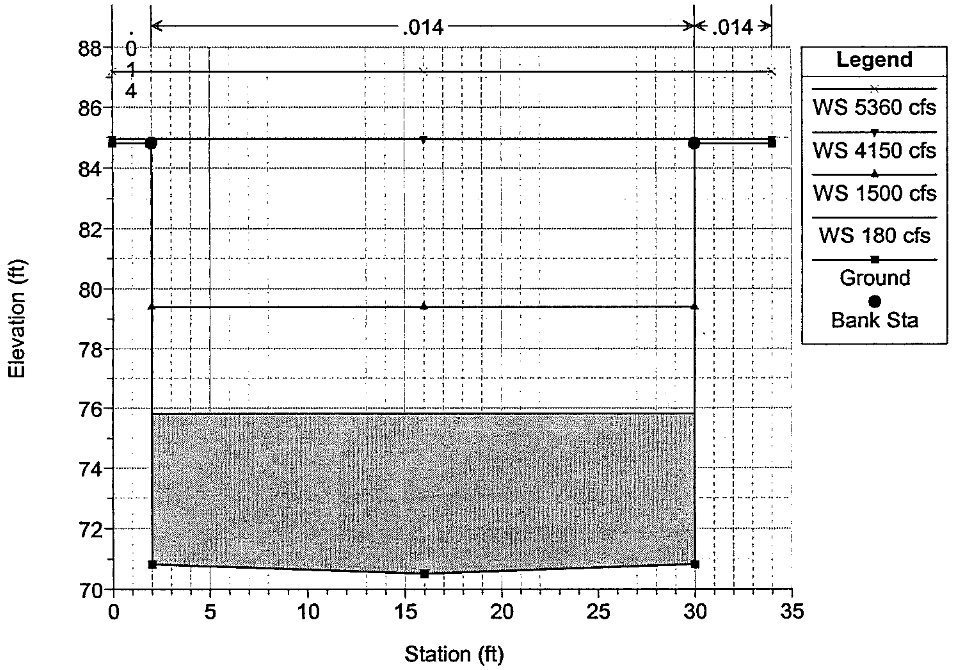
Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
one	130	12500.00	55.60	75.00	68.31	76.46	0.001910	9.85	1341.15	111.00	0.46
one	130	15000.00	55.60	76.00	69.68	77.79	0.002219	10.95	1453.05	112.80	0.50



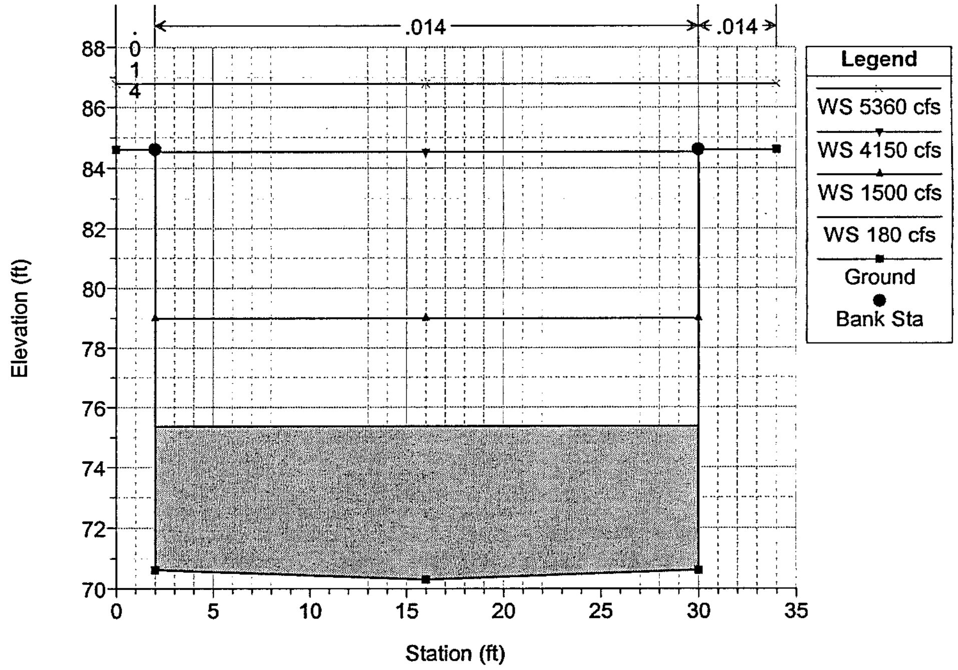
Bypass Channel Alignment Plan: 1) Plan 68
River = Bypass Channel Reach = One RS = 2600



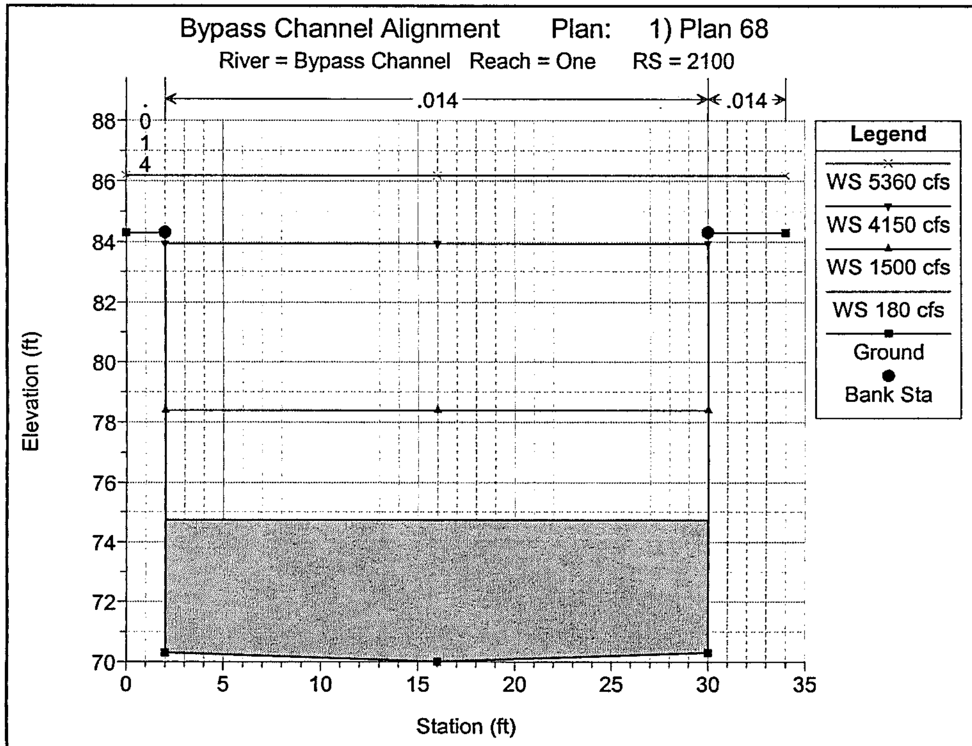
Bypass Channel Alignment Plan: 1) Plan 68
River = Bypass Channel Reach = One RS = 2500

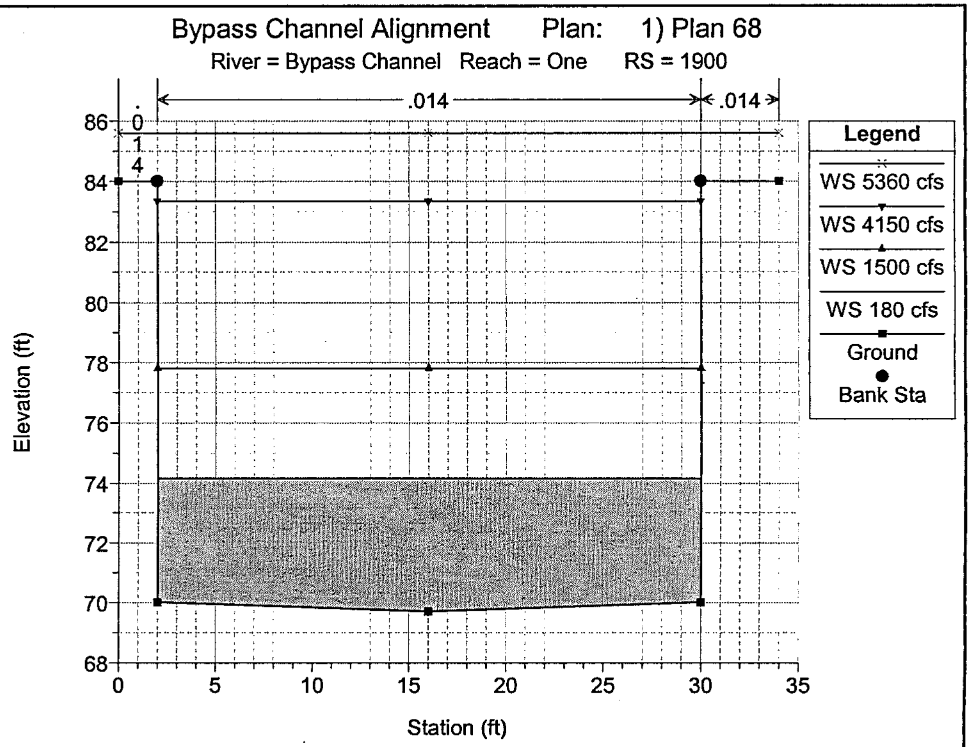


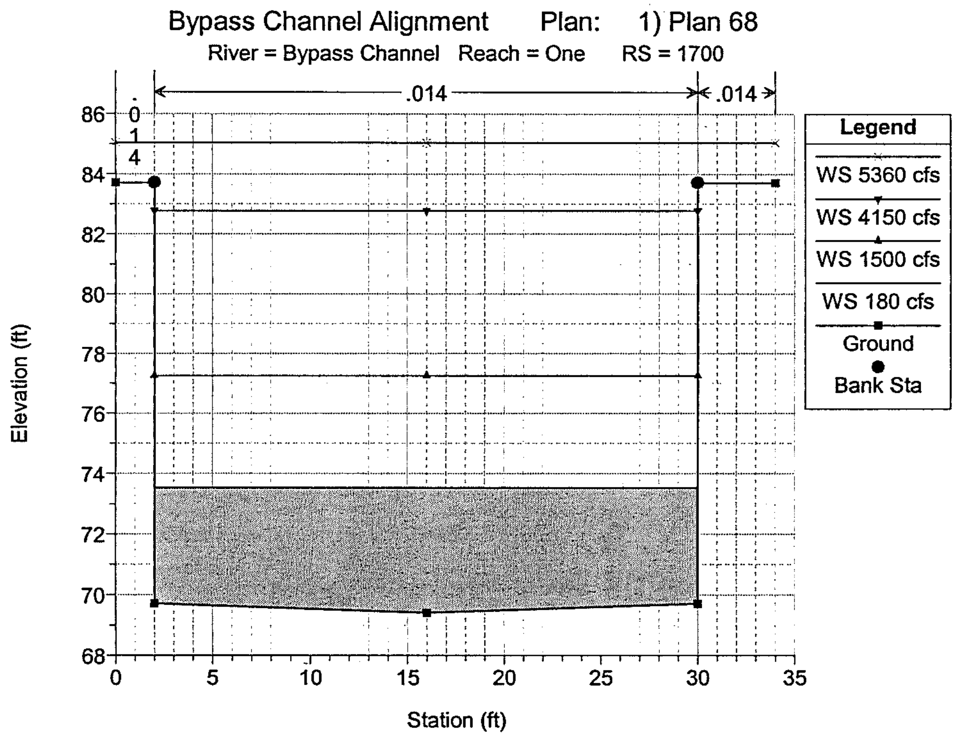
Bypass Channel Alignment Plan: 1) Plan 68
River = Bypass Channel Reach = One RS = 2450 Start of Double Box, End of U-channel

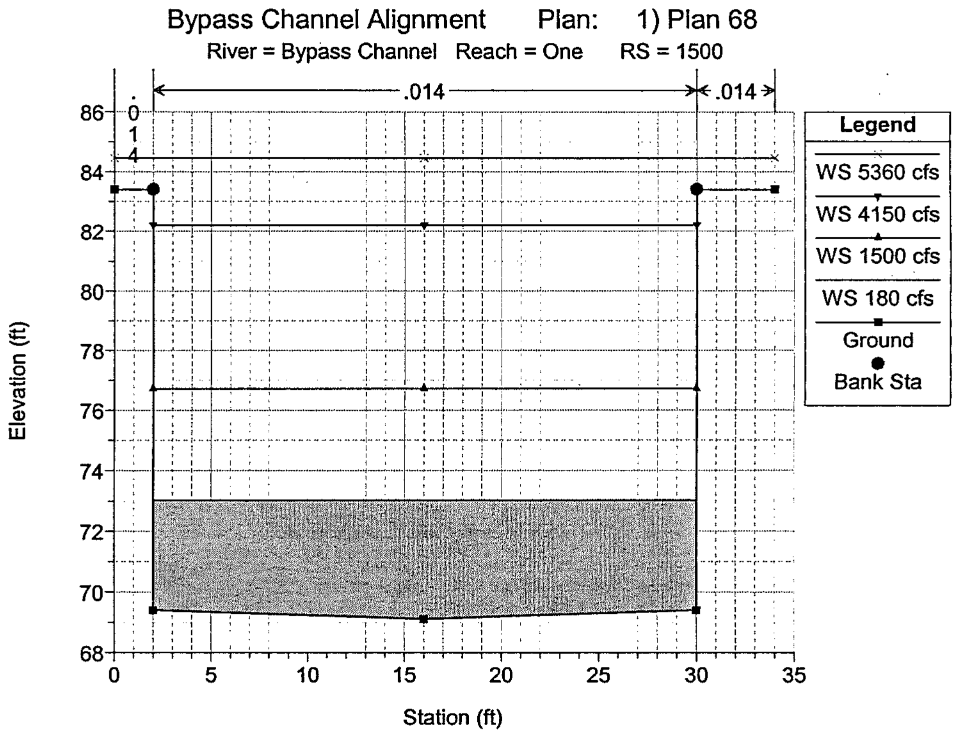


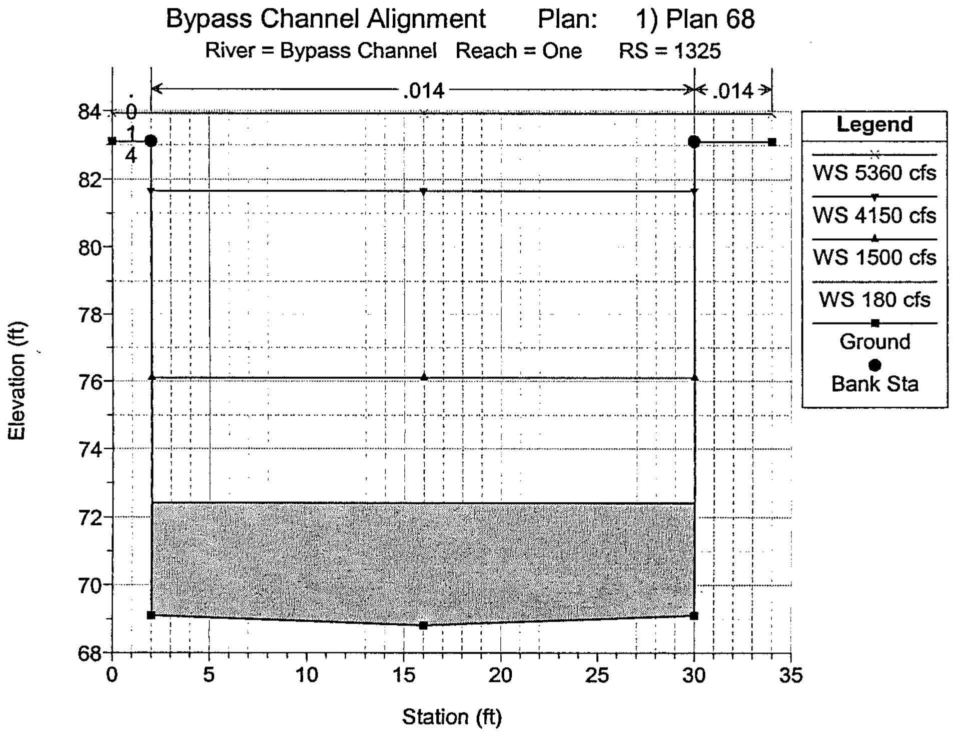
Bypass Channel Alignment Plan: 1) Plan 68
River = Bypass Channel Reach = One RS = 2300

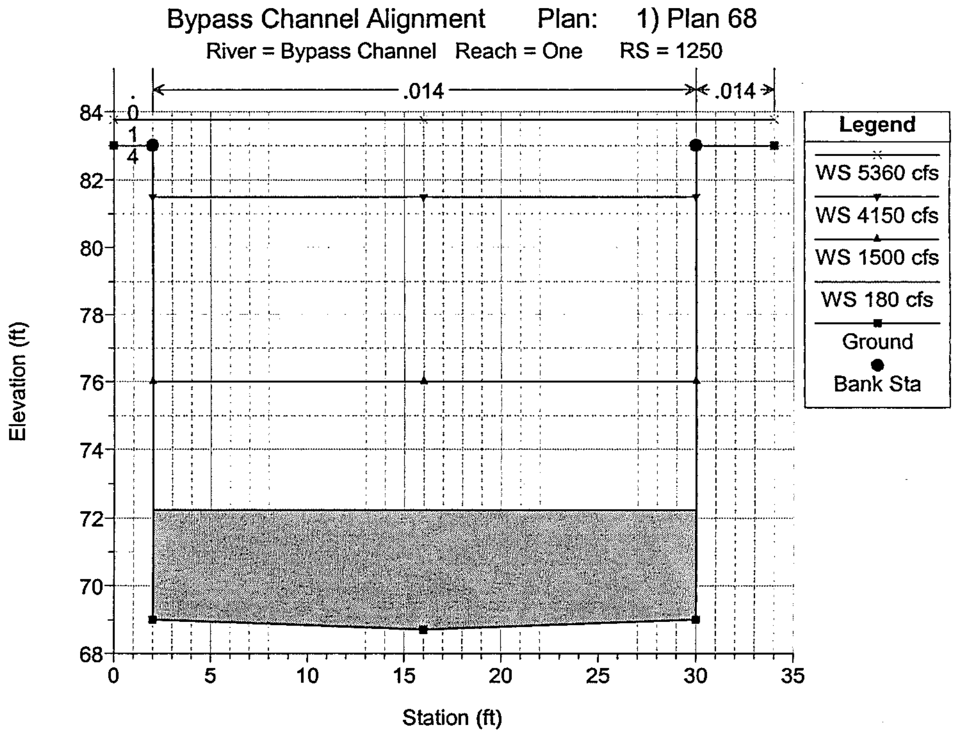

Bypass Channel Alignment Plan: 1) Plan 68
River = Bypass Channel Reach = One RS = 2100
.014
.014
.014
Legend
WS 5360 cfs
WS 4150 cfs
WS 1500 cfs
WS 180 cfs
Ground
Bank Sta
Elevation (ft)
88
86
84
82
80
78
76
74
72
70
Station (ft)
0
5
10
15
20
25
30
35

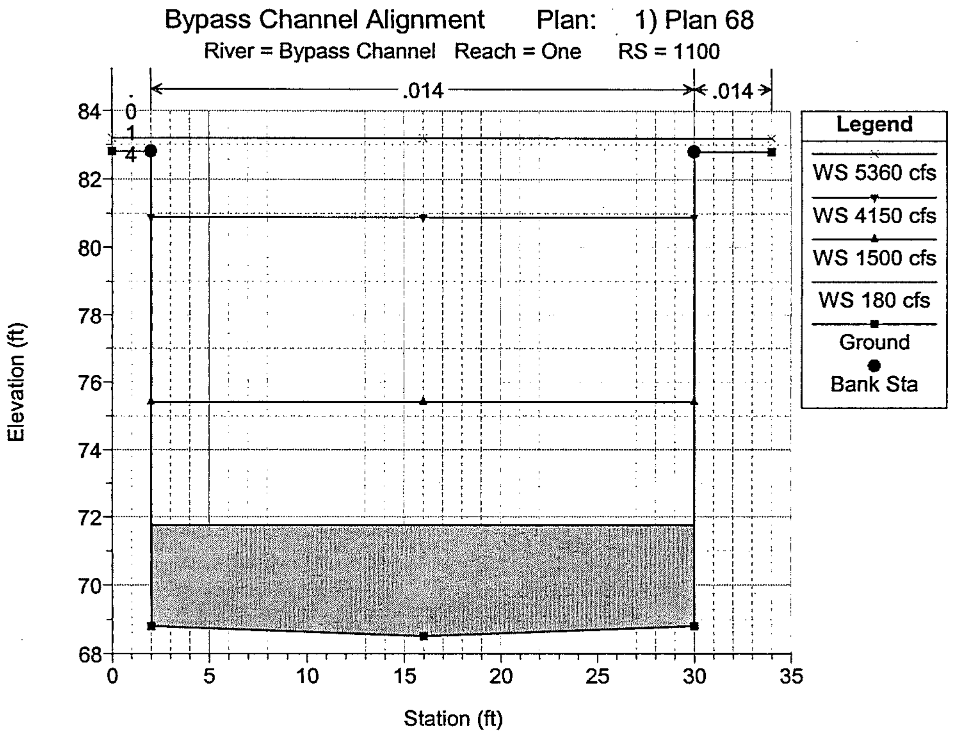

Bypass Channel Alignment Plan: 1) Plan 68
River = Bypass Channel Reach = One RS = 1900
.014
.014
.014
Legend
WS 5360 cfs
WS 4150 cfs
WS 1500 cfs
WS 180 cfs
Ground
Bank Sta
Elevation (ft)
86
84
82
80
78
76
74
72
70
68
Station (ft)
0
5
10
15
20
25
30
35

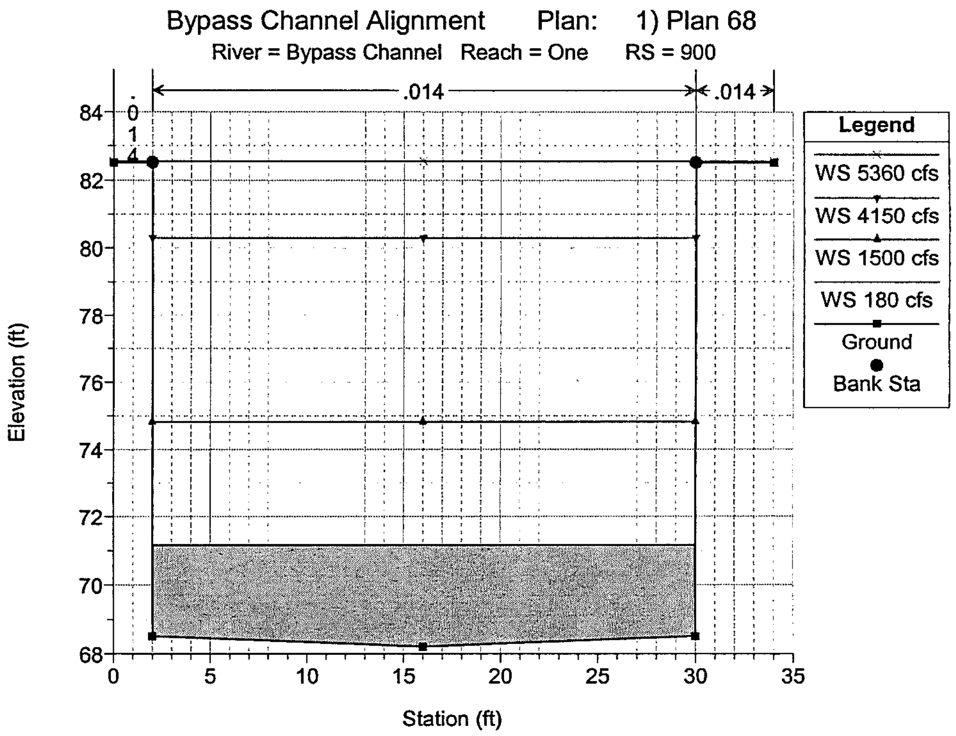

Bypass Channel Alignment Plan: 1) Plan 68
River = Bypass Channel Reach = One RS = 1700
.014
.014
.014
Legend
WS 5360 cfs
WS 4150 cfs
WS 1500 cfs
WS 180 cfs
Ground
Bank Sta
Elevation (ft)
86
84
82
80
78
76
74
72
70
68
Station (ft)
0
5
10
15
20
25
30
35

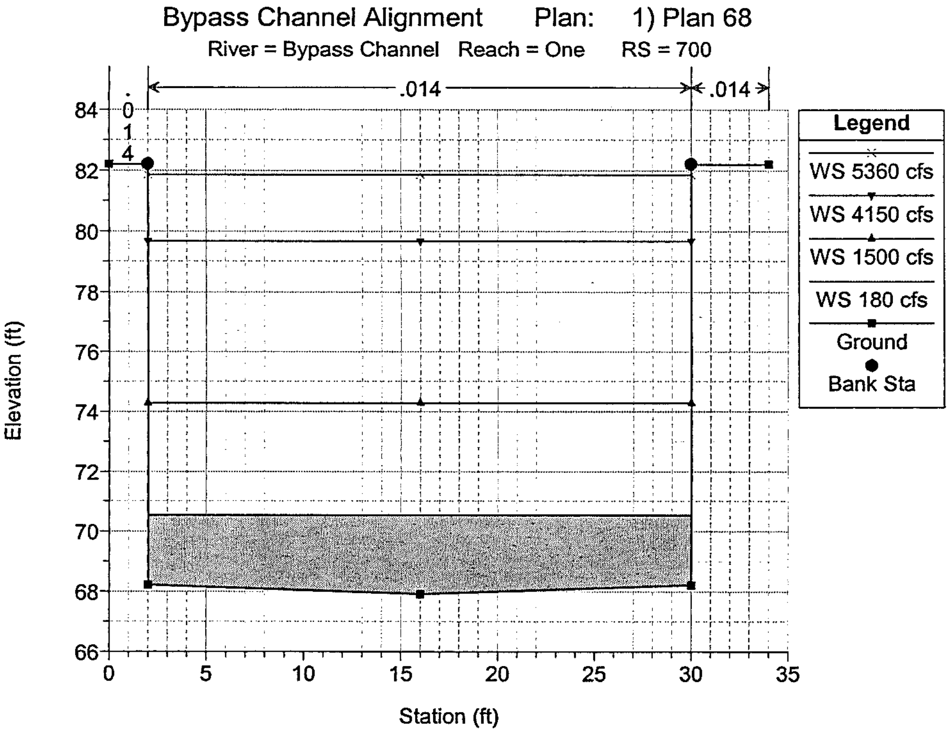

Bypass Channel Alignment Plan: 1) Plan 68
River = Bypass Channel Reach = One RS = 1500
.014
.014
.014
Legend
WS 5360 cfs
WS 4150 cfs
WS 1500 cfs
WS 180 cfs
Ground
Bank Sta
Elevation (ft)
86
84
82
80
78
76
74
72
70
68
Station (ft)
0
5
10
15
20
25
30
35

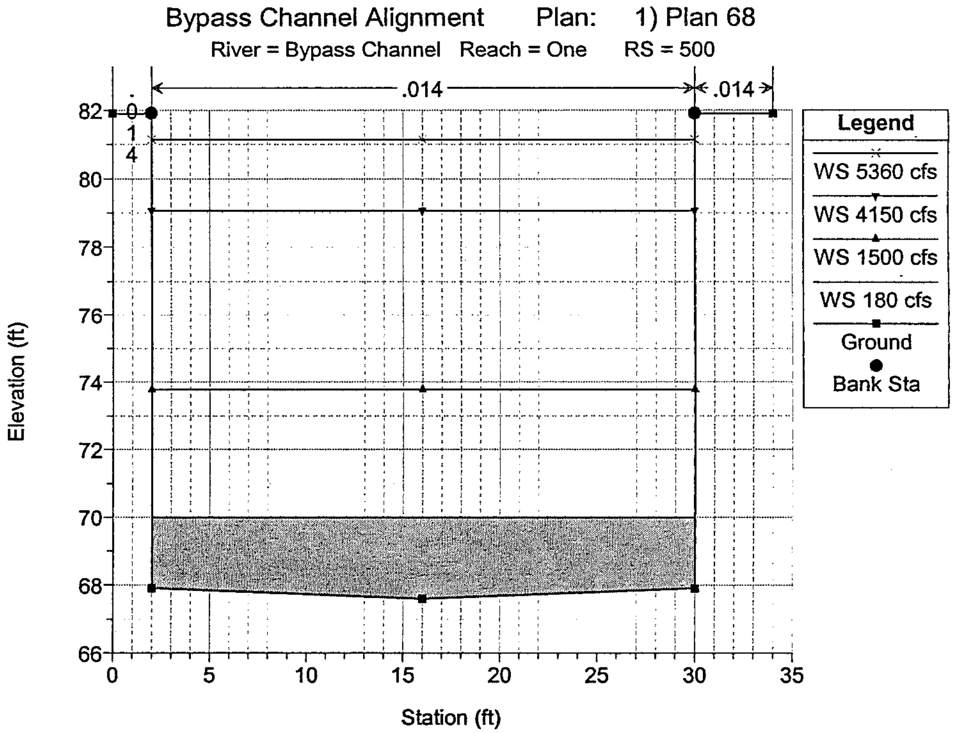

Bypass Channel Alignment Plan: 1) Plan 68
River = Bypass Channel Reach = One RS = 1325
.014
.014
.014
Legend
WS 5360 cfs
WS 4150 cfs
WS 1500 cfs
WS 180 cfs
Ground
Bank Sta
Elevation (ft)
84
82
80
78
76
74
72
70
68
Station (ft)
0
5
10
15
20
25
30
35

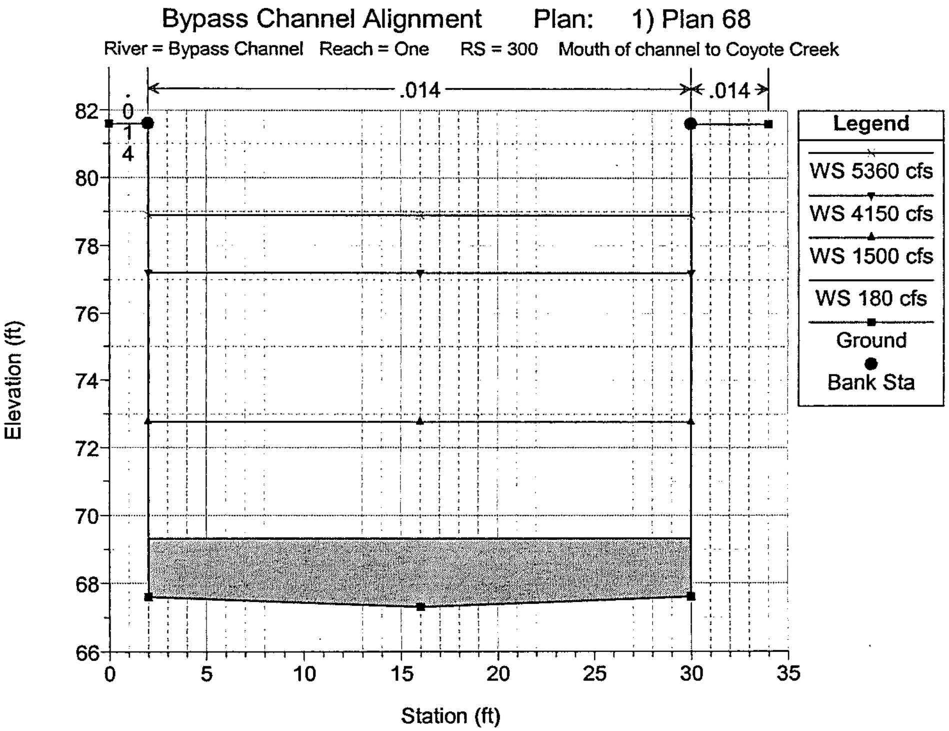

Bypass Channel Alignment Plan: 1) Plan 68
River = Bypass Channel Reach = One RS = 1250
.014
.014
.014
Legend
WS 5360 cfs
WS 4150 cfs
WS 1500 cfs
WS 180 cfs
Ground
Bank Sta
Elevation (ft)
84
82
80
78
76
74
72
70
68
Station (ft)
0
5
10
15
20
25
30
35


Bypass Channel Alignment Plan: 1) Plan 68
River = Bypass Channel Reach = One RS = 1100
.014
.014
.014
Legend
WS 5360 cfs
WS 4150 cfs
WS 1500 cfs
WS 180 cfs
Ground
Bank Sta
Elevation (ft)
84
82
80
78
76
74
72
70
68
Station (ft)
0
5
10
15
20
25
30
35


Bypass Channel Alignment Plan: 1) Plan 68
River = Bypass Channel Reach = One RS = 900
.014
.014
.014
Legend
WS 5360 cfs
WS 4150 cfs
WS 1500 cfs
WS 180 cfs
Ground
Bank Sta
Elevation (ft)
84
82
80
78
76
74
72
70
68
Station (ft)
0
5
10
15
20
25
30
35


Bypass Channel Alignment Plan: 1) Plan 68
River = Bypass Channel Reach = One RS = 700
.014
.014
.014
Elevation (ft)
84
82
80
78
76
74
72
70
68
66
0
5
10
15
20
25
30
35
Station (ft)
Legend
WS 5360 cfs
WS 4150 cfs
WS 1500 cfs
WS 180 cfs
Ground
Bank Sta


Bypass Channel Alignment Plan: 1) Plan 68
River = Bypass Channel Reach = One RS = 500
.014
.014
.014
Elevation (ft)
82
80
78
76
74
72
70
68
66
0
5
10
15
20
25
30
35
Station (ft)
Legend
WS 5360 cfs
WS 4150 cfs
WS 1500 cfs
WS 180 cfs
Ground
Bank Sta


Bypass Channel Alignment Plan: 1) Plan 68
River = Bypass Channel Reach = One RS = 300 Mouth of channel to Coyote Creek
.014
.014
.014
Elevation (ft)
82
80
78
76
74
72
70
68
66
0
5
10
15
20
25
30
35
Station (ft)
Legend
WS 5360 cfs
WS 4150 cfs
WS 1500 cfs
WS 180 cfs
Ground
Bank Sta

UPC Existing Conditions without King Road Bridge; Q = 2-yr, 2.8-yr, 5-yr, 10-yr, 12.5-yr, 100-yr, and 500-yr

HEC-RAS Plan: Plan 37 River: upper penitencia Reach: three

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
three	5427	400.00	97.70	102.23	100.84	102.41	0.004522	3.47	115.37	49.06	0.40
three	5427	600.00	97.70	103.03	101.39	103.26	0.004262	3.81	157.49	55.47	0.40
three	5427	1150.00	97.70	103.69	102.46	103.72	0.000392	1.27	845.19	310.07	0.12
three	5427	1800.00	97.70	103.69	103.50	103.76	0.000967	2.00	843.13	309.66	0.19
three	5427	2000.00	97.70	103.92	103.50	104.00	0.000953	2.07	918.12	324.17	0.19
three	5427	4740.00	97.70	104.57	103.50	104.85	0.002724	3.88	1131.98	329.58	0.34
three	5427	6000.00	97.70	105.08	103.51	105.36	0.002484	3.98	1416.46	393.00	0.33
three	5307	400.00	96.70	101.48	100.14	101.78	0.006084	4.38	91.37	33.70	0.47
three	5307	600.00	96.70	102.18	100.80	102.59	0.007081	5.17	116.12	37.33	0.52
three	5307	1150.00	96.70	103.63	102.20	103.67	0.000538	1.75	731.48	276.00	0.15
three	5307	1800.00	96.70	103.50	102.20	103.61	0.001544	2.90	696.79	276.00	0.25
three	5307	2000.00	96.70	103.75	102.23	103.86	0.001405	2.88	764.93	276.00	0.24
three	5307	4740.00	96.70	103.40	103.40	104.19	0.012161	8.01	668.65	274.14	0.71
three	5307	6000.00	96.70	103.58	103.45	104.68	0.015482	9.31	719.06	276.00	0.80
three	5052	400.00	95.70	99.83	98.58	100.15	0.006679	4.56	87.74	32.74	0.49
three	5052	600.00	95.70	100.86	99.23	101.22	0.005757	4.83	124.17	37.79	0.47
three	5052	1150.00	95.70	103.62	100.60	103.63	0.000054	0.67	1411.96	253.00	0.05
three	5052	1800.00	95.70	101.50	101.50	102.58	0.016070	8.64	216.52	69.91	0.80
three	5052	2000.00	95.70	101.50	101.50	102.84	0.019840	9.60	216.52	69.91	0.89
three	5052	4740.00	95.70	102.00	102.00	102.36	0.002824	3.88	1002.25	253.00	0.34
three	5052	6000.00	95.70	102.00	102.00	102.58	0.004526	4.91	1002.25	253.00	0.43
three	4923	400.00	95.00	99.18	97.64	99.41	0.004625	3.91	102.42	36.78	0.41
three	4923	600.00	95.00	100.36	98.27	100.61	0.003656	4.02	149.32	42.87	0.38
three	4923	1150.00	95.00	103.62	99.56	103.63	0.000040	0.64	1474.78	224.00	0.04
three	4923	1800.00	95.00	100.80	100.80	100.87	0.000614	1.72	834.89	216.17	0.16
three	4923	2000.00	95.00	100.80	100.80	100.89	0.000758	1.92	834.88	216.17	0.17
three	4923	4740.00	95.00	100.80	100.80	101.32	0.004257	4.54	834.88	216.17	0.41
three	4923	6000.00	95.00	101.31	100.81	101.94	0.004510	5.03	956.65	224.00	0.43
three	4827	400.00	93.80	98.64	96.43	98.95	0.004735	4.48	89.19	19.60	0.37
three	4827	600.00	93.80	99.65	97.17	100.12	0.006012	5.51	108.93	19.60	0.41
three	4827	1150.00	93.80	103.62	99.81	103.62	0.000029	0.50	1779.57	272.00	0.03
three	4827	1800.00	93.80	99.83	99.81	99.93	0.001056	2.16	751.95	253.29	0.16
three	4827	2000.00	93.80	99.83	99.81	99.95	0.001303	2.40	752.15	253.38	0.18
three	4827	4740.00	93.80	100.20	99.81	100.69	0.005623	5.19	850.02	272.00	0.37
three	4827	6000.00	93.80	100.96	99.81	101.48	0.004393	4.96	1057.80	272.00	0.33
three	4816	Bridge									
three	4804	400.00	93.60	97.31	97.31	98.54	0.035763	8.89	44.97	18.34	1.00
three	4804	600.00	93.60	98.11	98.11	99.65	0.034672	9.96	60.25	19.53	1.00
three	4804	1150.00	93.60	99.46	99.46	100.50	0.019130	8.94	146.42	61.60	0.75
three	4804	1800.00	93.60	99.80	99.80	99.89	0.001013	1.87	761.88	262.25	0.15
three	4804	2000.00	93.60	99.80	99.80	99.91	0.001250	2.08	761.88	262.25	0.17
three	4804	4740.00	93.60	99.96	99.80	100.53	0.006046	4.68	805.61	271.87	0.37
three	4804	6000.00	93.60	100.79	99.81	101.33	0.004822	4.63	1032.51	274.00	0.34
three	4700	400.00	93.20	97.06	95.95	97.07	0.000418	1.17	372.34	208.07	0.12
three	4700	600.00	93.20	97.60	96.64	97.62	0.000396	1.24	486.42	210.97	0.12
three	4700	1150.00	93.20	97.19	97.00	97.32	0.002747	3.06	399.71	208.77	0.31
three	4700	1800.00	93.20	97.55	97.00	97.77	0.003837	3.84	475.43	210.69	0.37
three	4700	2000.00	93.20	97.71	97.00	97.95	0.003797	3.91	508.99	211.54	0.37
three	4700	4740.00	93.20	99.66	97.77	100.04	0.003063	4.63	968.73	252.00	0.36
three	4700	6000.00	93.20	100.54	98.51	100.94	0.002501	4.65	1190.32	252.00	0.33
three	4568	400.00	92.20	96.47	95.30	96.89	0.008052	5.21	76.78	25.80	0.53
three	4568	600.00	92.20	96.00	96.00	97.33	0.029315	9.23	64.98	24.58	1.00
three	4568	1150.00	92.20	96.93	96.70	97.03	0.001702	2.57	450.10	194.51	0.25
three	4568	1800.00	92.20	97.09	96.70	97.31	0.003329	3.69	482.36	195.26	0.35
three	4568	2000.00	92.20	97.25	96.70	97.49	0.003336	3.80	517.57	215.75	0.35
three	4568	4740.00	92.20	99.26	97.28	99.63	0.003045	4.88	980.72	257.85	0.36
three	4568	6000.00	92.20	100.23	97.73	100.60	0.002477	4.89	1245.02	280.00	0.34
three	4565	Lat. Weir									
three	4445	400.00	91.50	95.51	94.60	95.84	0.008717	4.61	86.77	39.68	0.55
three	4445	600.00	91.50	96.07	95.19	96.11	0.000834	1.57	369.38	179.63	0.17
three	4445	1150.00	91.50	96.76	95.80	96.84	0.001251	2.17	498.22	194.35	0.22
three	4445	1800.00	91.50	96.67	95.80	96.89	0.003398	3.52	481.18	192.47	0.36

HEC-RAS Plan: Plan 37 River: upper penitencia Reach: three (Continued)

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
three	4445	2000.00	91.50	96.83	95.80	97.06	0.003450	3.64	523.40	222.65	0.37
three	4445	4740.00	91.50	98.95	96.91	99.29	0.002508	4.40	1025.48	242.00	0.34
three	4445	6000.00	91.50	99.97	97.36	100.32	0.001988	4.42	1272.47	242.00	0.31
three	4313	400.00	90.30	94.59	93.22	94.89	0.005950	4.46	89.69	31.38	0.46
three	4313	600.00	90.30	95.45	93.86	95.85	0.006155	5.08	118.18	34.67	0.48
three	4313	1150.00	90.30	96.65	95.24	96.71	0.000818	2.18	592.97	226.88	0.18
three	4313	1800.00	90.30	96.24	96.10	96.45	0.003262	4.08	502.64	219.46	0.36
three	4313	2000.00	90.30	96.38	96.10	96.61	0.003380	4.25	533.47	222.02	0.37
three	4313	4740.00	90.30	98.65	96.46	98.95	0.002390	4.79	1095.34	277.00	0.33
three	4313	6000.00	90.30	99.78	96.88	100.06	0.001688	4.49	1406.82	277.00	0.29
three	4190	400.00	89.10	92.40	92.40	93.42	0.030418	8.13	49.22	23.93	1.00
three	4190	600.00	89.10	93.09	93.09	94.35	0.028920	8.99	66.71	26.62	1.00
three	4190	1150.00	89.10	94.55	94.55	96.25	0.026524	10.47	109.81	32.31	1.00
three	4190	1800.00	89.10	95.50	95.50	95.87	0.006810	5.84	394.74	220.25	0.52
three	4190	2000.00	89.10	95.59	95.50	96.00	0.007240	6.12	415.25	220.76	0.54
three	4190	4740.00	89.10	98.36	96.27	98.66	0.002249	4.83	1069.63	245.00	0.33
three	4190	6000.00	89.10	99.54	96.68	99.85	0.001643	4.59	1360.15	245.00	0.29
three	3988	400.00	86.20	90.94	89.21	91.14	0.003479	3.62	110.64	35.38	0.36
three	3988	600.00	86.20	91.81	89.78	92.09	0.003722	4.21	142.50	37.70	0.38
three	3988	1150.00	86.20	93.75	91.02	94.17	0.003891	5.21	220.53	42.85	0.41
three	3988	1800.00	86.20	95.00	92.19	95.15	0.001386	3.48	606.14	184.49	0.25
three	3988	2000.00	86.20	95.22	92.52	95.38	0.001414	3.60	646.22	187.00	0.25
three	3988	4740.00	86.20	98.07	94.61	98.32	0.001206	4.26	1179.09	187.00	0.25
three	3988	6000.00	86.20	99.29	95.07	99.58	0.001092	4.40	1407.55	187.00	0.24
three	3880	400.00	85.90	90.37	89.13	90.65	0.006054	4.22	94.71	37.03	0.47
three	3880	600.00	85.90	91.27	89.73	91.60	0.005618	4.60	130.32	42.13	0.46
three	3880	1150.00	85.90	93.32	90.97	93.72	0.004430	5.03	228.58	53.74	0.43
three	3880	1800.00	85.90	94.57	92.09	94.91	0.003268	4.91	410.80	124.00	0.38
three	3880	2000.00	85.90	94.77	92.40	95.13	0.003428	5.16	434.60	124.00	0.39
three	3880	4740.00	85.90	97.48	95.02	98.08	0.003332	6.68	770.55	124.00	0.41
three	3880	6000.00	85.90	98.67	95.63	99.35	0.003061	7.02	918.90	124.00	0.41
three	3791	400.00	85.30	89.90	88.40	90.17	0.004882	4.17	96.01	31.70	0.42
three	3791	600.00	85.30	90.75	89.01	91.12	0.005219	4.83	124.12	34.04	0.45
three	3791	1150.00	85.30	92.77	90.35	93.27	0.005308	5.72	201.14	42.96	0.47
three	3791	1800.00	85.30	94.13	91.65	94.57	0.004257	5.62	357.23	101.97	0.43
three	3791	2000.00	85.30	94.27	92.00	94.76	0.004744	5.99	371.19	102.49	0.45
three	3791	4740.00	85.30	97.12	94.92	97.77	0.003687	6.96	745.18	125.00	0.43
three	3791	6000.00	85.30	98.36	95.52	99.07	0.003247	7.17	900.90	125.00	0.41
three	3663	400.00	84.40	88.40	87.97	89.05	0.017523	6.50	61.55	27.76	0.77
three	3663	600.00	84.40	89.61	88.65	90.18	0.010722	6.07	98.85	33.99	0.63
three	3663	1150.00	84.40	91.99	90.02	92.53	0.006272	5.91	194.56	46.28	0.51
three	3663	1800.00	84.40	92.96	91.26	93.79	0.008275	7.36	253.31	79.80	0.60
three	3663	2000.00	84.40	93.59	91.59	94.13	0.005193	6.24	365.59	121.00	0.48
three	3663	4740.00	84.40	96.61	94.44	97.29	0.003728	7.16	731.35	121.00	0.44
three	3663	6000.00	84.40	97.93	95.06	98.65	0.003216	7.33	890.71	121.00	0.42
three	3631	400.00	84.30	88.49	86.65	88.71	0.003515	3.78	105.87	29.37	0.35
three	3631	600.00	84.30	89.62	87.21	89.91	0.003467	4.31	139.16	29.48	0.35
three	3631	1150.00	84.30	91.90	88.51	92.36	0.003865	5.49	226.54	129.68	0.37
three	3631	1800.00	84.30	93.29	89.77	93.49	0.001811	4.22	587.05	229.70	0.26
three	3631	2000.00	84.30	93.78	90.11	93.94	0.001377	3.83	698.97	229.70	0.23
three	3631	4740.00	84.30	96.91	93.50	97.09	0.000870	3.72	1418.38	229.70	0.19
three	3631	6000.00	84.30	98.26	93.88	98.45	0.000738	3.68	1727.75	229.70	0.18
three	3602	400.00	83.90	88.17	86.59	88.55	0.006643	4.91	81.40	21.72	0.45
three	3602	600.00	83.90	89.23	87.29	89.74	0.007169	5.74	104.47	21.82	0.46
three	3602	1150.00	83.90	91.24	88.86	92.15	0.009819	7.64	150.54	25.28	0.55
three	3602	1800.00	83.90	93.09	90.50	93.40	0.003612	5.35	467.61	227.40	0.35
three	3602	2000.00	83.90	93.67	91.02	93.88	0.002255	4.45	599.99	227.40	0.28
three	3602	4740.00	83.90	96.86	93.73	97.06	0.001078	3.86	1325.18	227.40	0.20
three	3602	6000.00	83.90	98.21	94.10	98.42	0.000876	3.75	1633.12	227.40	0.19
three	3548	400.00	83.40	87.84	86.30	88.20	0.006161	4.81	83.21	25.51	0.47
three	3548	600.00	83.40	88.93	87.04	89.37	0.005962	5.33	112.54	28.43	0.47
three	3548	1150.00	83.40	91.09	88.64	91.66	0.005417	6.18	200.39	68.36	0.47
three	3548	1800.00	83.40	92.54	90.08	93.15	0.004842	6.59	301.10	70.39	0.46

HEC-RAS Plan: Plan 37 River: upper penitencia Reach: three (Continued)

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
three	3548	2000.00	83.40	93.11	91.18	93.68	0.004211	6.40	341.55	71.19	0.43
three	3548	4740.00	83.40	96.30	93.68	96.92	0.003000	6.78	753.76	104.00	0.38
three	3548	6000.00	83.40	97.57	94.40	98.29	0.002886	7.21	886.06	104.00	0.38
three	3358	400.00	81.00	86.67	84.98	87.04	0.006117	4.89	81.87	23.86	0.46
three	3358	600.00	81.00	87.73	85.79	88.20	0.006328	5.51	108.81	26.86	0.48
three	3358	1150.00	81.00	89.80	87.48	90.51	0.006723	6.73	173.83	54.25	0.52
three	3358	1800.00	81.00	91.33	88.97	92.10	0.006094	7.31	268.43	63.06	0.51
three	3358	2000.00	81.00	89.52	89.28	91.90	0.024113	12.39	161.47	33.48	0.97
three	3358	4740.00	81.00	92.93	92.93	95.59	0.017285	13.73	370.74	64.98	0.87
three	3358	6000.00	81.00	93.85	93.85	96.94	0.017923	14.75	430.83	66.09	0.90
three	3157	400.00	80.60	85.61	83.83	85.91	0.004970	4.45	89.82	26.23	0.42
three	3157	600.00	80.60	86.63	84.57	87.03	0.005223	5.09	117.89	28.86	0.44
three	3157	1150.00	80.60	88.54	86.14	89.19	0.006177	6.47	177.77	33.80	0.50
three	3157	1800.00	80.60	88.11	87.58	89.99	0.018999	11.00	163.62	32.70	0.87
three	3157	2000.00	80.60	89.21	87.95	89.62	0.004242	5.67	410.49	140.00	0.42
three	3157	4740.00	80.60	92.09	89.71	92.63	0.002981	6.23	813.96	140.00	0.37
three	3157	6000.00	80.60	93.13	90.27	93.75	0.002839	6.56	958.85	140.00	0.37
three	2957	400.00	79.50	83.93	83.03	84.47	0.010982	5.91	67.71	23.81	0.62
three	2957	600.00	79.50	85.01	83.77	85.63	0.009543	6.30	95.31	27.03	0.59
three	2957	1150.00	79.50	87.26	85.36	87.91	0.006550	6.65	191.99	72.95	0.51
three	2957	1800.00	79.50	88.79	87.90	88.90	0.001064	3.14	687.95	205.00	0.22
three	2957	2000.00	79.50	89.03	87.90	89.16	0.001052	3.20	738.75	205.00	0.22
three	2957	4740.00	79.50	92.05	88.19	92.24	0.000847	3.66	1356.62	205.00	0.21
three	2957	6000.00	79.50	93.12	88.60	93.35	0.000835	3.89	1576.65	205.00	0.21
three	2955	Lat. Weir									
three	2680	400.00	77.10	82.73	80.49	82.94	0.002986	3.64	109.81	29.85	0.33
three	2680	600.00	77.10	83.91	81.16	84.17	0.002961	4.09	146.61	32.73	0.34
three	2680	1150.00	77.10	87.22	82.63	87.30	0.000691	2.65	555.35	179.00	0.18
three	2680	1800.00	77.10	88.60	83.98	88.68	0.000567	2.70	802.45	179.00	0.16
three	2680	2000.00	77.10	88.84	84.33	88.93	0.000595	2.82	845.70	179.00	0.17
three	2680	4740.00	77.10	91.84	87.26	92.03	0.000703	3.73	1383.28	179.00	0.19
three	2680	6000.00	77.10	92.90	87.72	93.13	0.000746	4.07	1572.84	179.00	0.20
three	2567	400.00	76.30	82.37	80.03	82.59	0.003206	3.76	106.30	27.75	0.34
three	2567	600.00	76.30	83.52	80.81	83.81	0.003279	4.30	139.45	29.48	0.35
three	2567	1150.00	76.30	86.79	82.29	87.14	0.002482	4.72	243.78	34.37	0.31
three	2567	1800.00	76.30	88.32	83.68	88.57	0.001639	4.31	480.71	99.00	0.26
three	2567	2000.00	76.30	88.54	84.06	88.81	0.001784	4.57	501.66	99.00	0.27
three	2567	4740.00	76.30	91.24	87.94	91.84	0.002722	6.76	768.94	99.00	0.35
three	2567	6000.00	76.30	92.15	88.63	92.92	0.003089	7.57	859.06	99.00	0.38
three	2477	400.00	76.80	81.88	80.08	82.21	0.005232	4.61	86.84	22.91	0.42
three	2477	600.00	76.80	82.97	80.78	83.41	0.005616	5.35	112.22	23.93	0.44
three	2477	1150.00	76.80	86.31	82.38	86.83	0.004456	5.77	199.16	30.20	0.39
three	2477	1800.00	76.80	88.17	83.91	88.39	0.001975	4.27	513.69	160.00	0.27
three	2477	2000.00	76.80	88.38	84.33	88.62	0.002041	4.42	547.54	160.00	0.28
three	2477	4740.00	76.80	91.21	88.26	91.57	0.001847	5.16	999.68	160.00	0.28
three	2477	6000.00	76.80	92.18	88.76	92.60	0.001873	5.51	1154.39	160.00	0.28
three	2350	400.00	76.00	80.28		81.06	0.016929	7.10	56.33	19.19	0.73
three	2350	600.00	76.00	81.22		82.22	0.016623	8.03	74.74	19.82	0.73
three	2350	1150.00	76.00	85.48		86.14	0.006280	6.50	176.83	28.88	0.46
three	2350	1800.00	76.00	87.12		87.93	0.006281	7.44	272.50	87.45	0.48
three	2350	2000.00	76.00	87.04		88.08	0.008183	8.43	265.48	86.12	0.54
three	2350	4740.00	76.00	88.95	88.95	90.91	0.012907	12.33	453.13	102.00	0.71
three	2350	6000.00	76.00	89.63	89.63	91.91	0.013813	13.37	522.67	102.00	0.74
three	2298	400.00	75.30	80.08	78.64	80.42	0.006381	4.66	85.80	25.25	0.45
three	2298	600.00	75.30	81.10	79.25	81.55	0.006491	5.37	111.70	25.58	0.45
three	2298	1150.00	75.30	85.43	80.68	85.84	0.003128	5.10	225.66	26.98	0.31
three	2298	1800.00	75.30	87.44	82.10	87.59	0.001327	3.72	637.53	227.30	0.20
three	2298	2000.00	75.30	87.48	82.50	87.67	0.001581	4.07	646.68	227.30	0.22
three	2298	4740.00	75.30	89.23	87.35	89.57	0.002288	5.44	1045.05	227.30	0.28
three	2298	6000.00	75.30	90.21	87.79	90.57	0.002016	5.38	1267.64	227.30	0.26
three	2272	Bridge									

HEC-RAS Plan: Plan 37 River: upper penitencia Reach: three (Continued)

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
three	2257	400.00	75.60	79.75	78.45	80.13	0.007318	4.97	80.55	24.45	0.48
three	2257	600.00	75.60	80.75	79.09	81.26	0.007397	5.71	105.15	24.66	0.49
three	2257	1150.00	75.60	84.12	80.55	84.69	0.004949	6.07	189.46	25.38	0.39
three	2257	1800.00	75.60	85.43	81.97	86.44	0.007706	8.08	222.91	25.66	0.48
three	2257	2000.00	75.60	85.57	82.37	86.78	0.009106	8.83	226.47	25.69	0.52
three	2257	4740.00	75.60	88.68	87.45	89.15	0.003514	6.51	913.65	225.90	0.33
three	2257	6000.00	75.60	89.82	87.85	90.24	0.002629	5.99	1169.76	225.90	0.29
three	2210	400.00	75.30	79.50		79.81	0.005621	4.50	88.87	28.74	0.45
three	2210	600.00	75.30	80.54		80.92	0.005386	4.97	120.76	32.33	0.45
three	2210	1150.00	75.30	84.15		84.45	0.002428	4.43	260.53	75.02	0.32
three	2210	1800.00	75.30	85.76		86.06	0.002009	4.66	450.00	136.00	0.31
three	2210	2000.00	75.30	86.01		86.33	0.002081	4.85	483.86	136.00	0.31
three	2210	4740.00	75.30	88.40		88.99	0.002786	6.76	809.49	136.00	0.38
three	2210	6000.00	75.30	89.43		90.09	0.002759	7.18	948.57	136.00	0.38
three	2035	400.00	74.00	79.10		79.24	0.001820	2.92	136.94	36.57	0.27
three	2035	600.00	74.00	80.14		80.32	0.001986	3.40	176.62	39.78	0.28
three	2035	1150.00	74.00	84.01		84.16	0.000924	3.18	395.06	117.70	0.21
three	2035	1800.00	74.00	85.66		85.81	0.000786	3.36	659.63	185.00	0.20
three	2035	2000.00	74.00	85.90		86.06	0.000826	3.50	705.09	185.00	0.20
three	2035	4740.00	74.00	88.29		88.59	0.001217	4.96	1147.17	185.00	0.26
three	2035	6000.00	74.00	89.35		89.68	0.001217	5.26	1341.86	185.00	0.26
three	2012	400.00	74.60	78.88	77.48	79.15	0.005660	4.20	95.28	33.75	0.44
three	2012	600.00	74.60	79.92	78.10	80.24	0.005048	4.53	132.44	37.68	0.43
three	2012	1150.00	74.60	83.89	79.41	84.13	0.001756	3.92	293.60	41.00	0.26
three	2012	1800.00	74.60	85.43	80.61	85.76	0.002047	4.71	454.05	195.00	0.28
three	2012	2000.00	74.60	85.68	80.92	86.02	0.002106	4.87	503.39	195.00	0.29
three	2012	4740.00	74.60	88.13	84.19	88.54	0.002272	5.94	979.58	195.00	0.31
three	2012	6000.00	74.60	89.21	86.65	89.64	0.002028	5.96	1191.59	195.00	0.30
three	2000	Bridge									
three	1988	400.00	74.40	78.69	77.10	78.93	0.004559	3.95	101.25	35.04	0.41
three	1988	600.00	74.40	79.74	77.74	80.03	0.004040	4.29	139.73	38.06	0.39
three	1988	1150.00	74.40	82.85	79.05	83.14	0.002230	4.33	265.49	41.00	0.30
three	1988	1800.00	74.40	84.08	80.21	84.58	0.003265	5.70	316.31	49.65	0.36
three	1988	2000.00	74.40	84.33	80.53	84.91	0.003651	6.12	332.36	76.83	0.38
three	1988	4740.00	74.40	87.43	85.78	87.96	0.002847	6.66	889.91	191.00	0.35
three	1988	6000.00	74.40	88.99	86.36	89.43	0.001962	6.04	1187.62	191.00	0.30
three	1966	400.00	74.00	78.44		78.80	0.006828	4.81	83.24	28.54	0.50
three	1966	600.00	74.00	79.48		79.90	0.006267	5.23	114.68	32.17	0.49
three	1966	1150.00	74.00	82.73		83.07	0.003701	4.70	244.64	54.60	0.39
three	1966	1800.00	74.00	84.03		84.49	0.004765	5.44	340.32	125.65	0.45
three	1966	2000.00	74.00	84.32		84.80	0.004619	5.58	382.01	160.08	0.45
three	1966	4740.00	74.00	87.45		87.87	0.002447	5.66	945.98	181.00	0.35
three	1966	6000.00	74.00	88.99		89.37	0.001758	5.40	1224.10	181.00	0.31
three	1879	400.00	73.80	77.90		78.23	0.006173	4.61	86.84	29.17	0.47
three	1879	600.00	73.80	79.00		79.38	0.005375	4.97	120.64	32.05	0.45
three	1879	1150.00	73.80	82.47		82.80	0.002629	4.65	247.31	41.07	0.33
three	1879	1800.00	73.80	83.56		84.11	0.003732	6.01	320.06	102.33	0.41
three	1879	2000.00	73.80	83.82		84.41	0.003930	6.32	347.04	111.66	0.42
three	1879	4740.00	73.80	86.92		87.60	0.003251	7.32	764.02	137.00	0.40
three	1879	6000.00	73.80	88.56		89.17	0.002421	6.98	987.96	137.00	0.36
three	1795	400.00	72.30	77.48		77.76	0.004761	4.22	94.69	29.37	0.41
three	1795	600.00	72.30	78.64		78.96	0.004339	4.59	130.72	33.00	0.41
three	1795	1150.00	72.30	82.31		82.59	0.002104	4.21	273.23	44.54	0.30
three	1795	1800.00	72.30	83.35		83.80	0.003029	5.48	348.49	88.31	0.37
three	1795	2000.00	72.30	83.58		84.09	0.003270	5.82	369.23	91.93	0.38
three	1795	4740.00	72.30	86.29		87.25	0.004406	8.36	631.62	97.00	0.47
three	1795	6000.00	72.30	87.93		88.89	0.003602	8.37	791.07	97.00	0.43
three	1700	400.00	72.00	76.75	75.46	77.17	0.007941	5.17	77.32	26.08	0.53
three	1700	600.00	72.00	78.03	76.23	78.46	0.006290	5.28	113.69	31.00	0.49
three	1700	1150.00	72.00	82.11	77.80	82.38	0.002199	4.22	272.55	50.38	0.31
three	1700	1800.00	72.00	83.06	79.18	83.51	0.003049	5.47	355.80	99.03	0.37
three	1700	2000.00	72.00	83.27	79.56	83.77	0.003312	5.82	376.58	102.93	0.39
three	1700	4740.00	72.00	85.98	83.98	86.82	0.003977	7.94	680.02	113.00	0.45

HEC-RAS Plan: Plan 37 River: upper penitencia Reach: three (Continued)

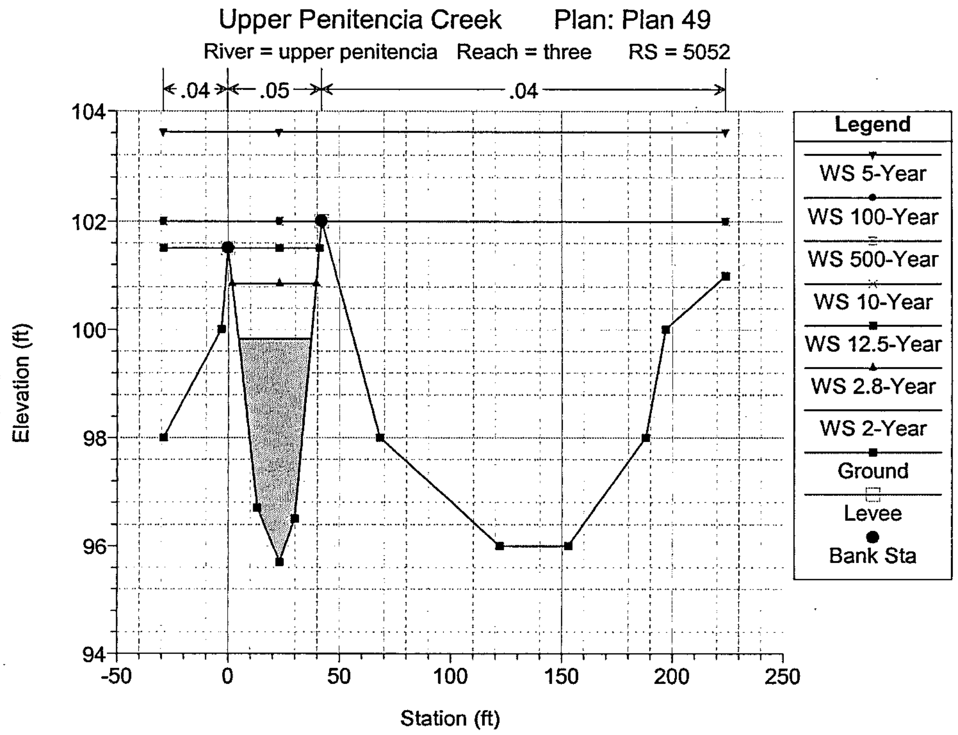
Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
three	1700	6000.00	72.00	87.76	84.73	88.52	0.002938	7.63	880.93	113.00	0.40
three	1572	400.00	71.30	76.27		76.48	0.003394	3.75	106.67	30.87	0.36
three	1572	600.00	71.30	77.65		77.89	0.002809	3.94	152.19	35.00	0.33
three	1572	1150.00	71.30	81.96		82.15	0.001220	3.48	330.75	47.87	0.23
three	1572	1800.00	71.30	82.82		83.17	0.001987	4.79	389.22	87.00	0.30
three	1572	2000.00	71.30	82.99		83.41	0.002255	5.18	404.71	91.85	0.32
three	1572	4740.00	71.30	85.50		86.33	0.003561	7.82	701.60	123.00	0.43
three	1572	6000.00	71.30	87.46		88.16	0.002460	7.29	943.24	123.00	0.36
three	1472	400.00	71.00	75.80	74.02	76.08	0.004581	4.26	93.84	27.85	0.41
three	1472	600.00	71.00	77.28	74.71	77.57	0.003499	4.35	137.81	31.82	0.37
three	1472	1150.00	71.00	81.80	76.21	82.01	0.001399	3.72	309.22	44.01	0.25
three	1472	1800.00	71.00	82.58	77.59	82.96	0.002332	5.04	396.53	135.45	0.32
three	1472	2000.00	71.00	82.74	77.97	83.17	0.002621	5.40	417.91	135.66	0.34
three	1472	4740.00	71.00	85.49	83.56	85.93	0.002247	6.10	972.05	206.00	0.33
three	1472	6000.00	71.00	87.57	84.15	87.87	0.001220	5.08	1399.34	206.00	0.25
three	1391	400.00	69.90	75.75	72.38	75.86	0.001243	2.56	156.19	38.01	0.22
three	1391	600.00	69.90	77.25	73.05	77.37	0.001131	2.76	217.32	43.73	0.22
three	1391	1150.00	69.90	81.86	74.48	81.92	0.000323	2.10	682.91	209.46	0.13
three	1391	1800.00	69.90	82.71	75.76	82.79	0.000446	2.63	876.24	240.00	0.15
three	1391	2000.00	69.90	82.90	76.10	82.99	0.000486	2.78	921.28	240.00	0.16
three	1391	4740.00	69.90	85.60	79.36	85.76	0.000599	3.64	1571.16	240.00	0.18
three	1391	6000.00	69.90	87.63	81.84	87.77	0.000416	3.36	2057.35	240.00	0.16
three	1369	400.00	69.90	75.55	72.84	75.80	0.003454	4.03	99.35	20.60	0.32
three	1369	600.00	69.90	76.97	73.59	77.31	0.003692	4.64	129.20	21.33	0.33
three	1369	1150.00	69.90	81.48	75.30	81.87	0.002765	4.98	232.28	64.21	0.28
three	1369	1800.00	69.90	82.01	76.96	82.71	0.004947	6.91	325.96	223.60	0.38
three	1369	2000.00	69.90	82.13	77.42	82.89	0.005535	7.36	351.41	223.60	0.40
three	1369	4740.00	69.90	85.41	83.43	85.72	0.002011	5.32	1084.43	223.60	0.25
three	1369	6000.00	69.90	87.51	83.84	87.75	0.001028	4.19	1555.44	223.60	0.19
three	1338	Bridge									
three	1310	400.00	69.80	74.36		74.90	0.010583	5.92	67.58	18.57	0.55
three	1310	600.00	69.80	75.16		75.98	0.013300	7.27	82.50	18.62	0.61
three	1310	1150.00	69.80	76.68		78.35	0.021063	10.37	110.88	18.70	0.75
three	1310	1800.00	69.80	77.88		80.71	0.030887	13.49	133.43	18.78	0.89
three	1310	2000.00	69.80	78.13	77.81	81.39	0.034692	14.48	138.12	18.79	0.94
three	1310	4740.00	69.80	85.27		85.46	0.001033	3.67	1336.60	218.90	0.17
three	1310	6000.00	69.80	87.46		87.63	0.000609	3.09	1815.79	218.90	0.13
three	1286	400.00	69.40	74.33		74.66	0.005343	4.59	87.19	25.66	0.44
three	1286	600.00	69.40	75.20		75.66	0.006231	5.43	110.49	28.05	0.48
three	1286	1150.00	69.40	77.06		77.79	0.007328	6.87	167.39	33.16	0.54
three	1286	1800.00	69.40	78.88		79.81	0.007469	7.73	232.86	38.95	0.56
three	1286	2000.00	69.40	79.40		80.37	0.007386	7.89	253.63	40.84	0.56
three	1286	4740.00	69.40	85.05		85.41	0.001645	5.62	1069.77	207.00	0.29
three	1286	6000.00	69.40	87.35		87.60	0.000875	4.63	1545.85	207.00	0.22
three	1208	400.00	70.10	73.94		74.22	0.005467	4.25	94.01	33.16	0.45
three	1208	600.00	70.10	74.81		75.17	0.005539	4.84	123.96	36.08	0.46
three	1208	1150.00	70.10	76.73		77.24	0.005299	5.77	199.44	42.55	0.47
three	1208	1800.00	70.10	78.65		79.26	0.004699	6.26	287.58	49.04	0.46
three	1208	2000.00	70.10	79.20		79.82	0.004519	6.35	314.88	50.88	0.45
three	1208	4740.00	70.10	84.11		85.15	0.004317	8.20	578.20	54.00	0.44
three	1208	6000.00	70.10	86.21		87.38	0.004126	8.67	691.75	54.00	0.43
three	1100	400.00	69.60	73.32		73.61	0.005918	4.29	93.24	34.61	0.46
three	1100	600.00	69.60	74.21		74.57	0.005605	4.79	125.22	37.42	0.46
three	1100	1150.00	69.60	76.19		76.67	0.004980	5.60	205.37	43.67	0.46
three	1100	1800.00	69.60	78.21		78.77	0.004200	5.99	300.32	50.08	0.43
three	1100	2000.00	69.60	78.78		79.35	0.004019	6.08	329.17	51.87	0.43
three	1100	4740.00	69.60	83.81		84.69	0.003301	7.61	637.04	63.00	0.40
three	1100	6000.00	69.60	85.98		86.94	0.002969	7.96	773.47	63.00	0.39
three	1027	400.00	68.50	72.63		73.05	0.009594	5.22	76.63	30.51	0.58
three	1027	600.00	68.50	73.57		74.06	0.008251	5.62	106.83	33.68	0.56
three	1027	1150.00	68.50	75.63		76.24	0.006548	6.26	183.62	40.64	0.52
three	1027	1800.00	68.50	77.77		78.42	0.005071	6.47	278.26	47.84	0.47

HEC-RAS Plan: Plan 37 River: upper penitencia Reach: three (Continued)

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
three	1027	2000.00	68.50	78.37		79.03	0.004686	6.51	307.95	53.48	0.46
three	1027	4740.00	68.50	84.09		84.38	0.001184	4.93	1222.75	238.00	0.26
three	1027	6000.00	68.50	86.43		86.62	0.000633	4.07	1777.85	238.00	0.19
three	1002	400.00	68.50	72.41	71.35	72.81	0.008815	5.12	78.10	29.51	0.55
three	1002	600.00	68.50	73.38	72.05	73.85	0.007732	5.55	108.12	32.46	0.54
three	1002	1150.00	68.50	75.47	73.44	76.08	0.006436	6.30	182.65	38.80	0.51
three	1002	1800.00	68.50	77.62	74.71	78.28	0.005243	6.56	274.23	46.61	0.48
three	1002	2000.00	68.50	78.23	75.06	78.90	0.004926	6.59	303.54	48.89	0.47
three	1002	4740.00	68.50	84.09	78.71	84.34	0.001039	4.55	1245.07	198.00	0.24
three	1002	6000.00	68.50	86.40	81.22	86.60	0.000637	4.03	1702.60	198.00	0.19
three	991	Bridge									
three	958	400.00	67.60	72.09		72.44	0.006437	4.80	83.39	26.93	0.48
three	958	600.00	67.60	73.06		73.52	0.006387	5.43	110.55	28.91	0.49
three	958	1150.00	67.60	75.11		75.78	0.006471	6.61	173.97	33.06	0.51
three	958	1800.00	67.60	76.95		77.83	0.006704	7.54	238.60	37.58	0.53
three	958	2000.00	67.60	77.45		78.39	0.006718	7.75	258.08	39.01	0.53
three	958	4740.00	67.60	83.77		84.11	0.001509	5.36	1087.95	191.00	0.27
three	958	6000.00	67.60	86.25		86.49	0.000812	4.46	1561.47	191.00	0.21
three	933	400.00	67.50	71.84		72.25	0.008212	5.16	77.57	27.52	0.54
three	933	600.00	67.50	72.85		73.34	0.007432	5.62	106.84	30.55	0.53
three	933	1150.00	67.50	74.97		75.62	0.006532	6.44	178.45	36.91	0.52
three	933	1800.00	67.50	76.85		77.64	0.006125	7.11	253.25	42.56	0.51
three	933	2000.00	67.50	77.38		78.19	0.005989	7.25	275.88	44.13	0.51
three	933	4740.00	67.50	83.77		84.07	0.001185	5.07	1184.20	215.00	0.25
three	933	6000.00	67.50	86.26		86.46	0.000633	4.19	1718.98	215.00	0.19
three	865	400.00	66.60	71.28		71.69	0.008251	5.15	77.66	27.63	0.54
three	865	600.00	66.60	72.38		72.83	0.007093	5.44	110.38	32.12	0.52
three	865	1150.00	66.60	74.62		75.17	0.005755	5.97	192.75	41.32	0.49
three	865	1800.00	66.60	76.58		77.21	0.005082	6.39	281.67	49.36	0.47
three	865	2000.00	66.60	77.13		77.78	0.004886	6.47	309.18	51.59	0.47
three	865	4740.00	66.60	83.07		83.89	0.003210	7.27	651.73	59.00	0.39
three	865	6000.00	66.60	85.42		86.31	0.002940	7.59	790.38	59.00	0.37
three	787	400.00	66.20	71.01		71.23	0.003565	3.79	105.50	31.41	0.36
three	787	600.00	66.20	72.13		72.41	0.003437	4.19	143.07	35.34	0.37
three	787	1150.00	66.20	74.40		74.78	0.003337	4.95	232.34	43.26	0.38
three	787	1800.00	66.20	76.37		76.85	0.003306	5.55	324.29	50.13	0.38
three	787	2000.00	66.20	76.92		77.42	0.003262	5.68	352.31	52.05	0.38
three	787	4740.00	66.20	82.94		83.63	0.002521	6.66	711.41	62.00	0.35
three	787	6000.00	66.20	85.32		86.08	0.002342	6.99	858.55	62.00	0.33
three	695	400.00	64.80	70.86		70.99	0.001593	2.83	141.34	35.65	0.25
three	695	600.00	64.80	71.99		72.15	0.001730	3.27	183.46	39.29	0.27
three	695	1150.00	64.80	74.25		74.51	0.001965	4.09	280.88	46.63	0.29
three	695	1800.00	64.80	76.22		76.57	0.002130	4.75	378.81	52.99	0.31
three	695	2000.00	64.80	76.77		77.14	0.002144	4.90	408.42	54.77	0.32
three	695	4740.00	64.80	82.83		83.39	0.001913	6.03	785.96	65.00	0.31
three	695	6000.00	64.80	85.22		85.85	0.001818	6.37	941.21	65.00	0.30
three	586	400.00	65.00	69.15	69.15	70.42	0.031746	9.02	44.37	17.90	1.01
three	586	600.00	65.00	70.02	70.02	71.53	0.029771	9.84	60.95	20.27	1.00
three	586	1150.00	65.00	71.78	71.78	73.80	0.027893	11.42	100.69	25.06	1.00
three	586	1800.00	65.00	74.04		75.90	0.018243	10.95	164.42	31.23	0.84
three	586	2000.00	65.00	74.63		76.48	0.016869	10.92	183.13	32.83	0.81
three	586	4740.00	65.00	81.55		82.96	0.006171	9.71	511.94	67.00	0.53
three	586	6000.00	65.00	84.30		85.50	0.004177	9.05	696.19	67.00	0.44
three	470	400.00	62.70	68.45		68.60	0.002130	3.10	129.18	35.77	0.29
three	470	600.00	62.70	69.84		70.01	0.001819	3.30	181.90	40.22	0.27
three	470	1150.00	62.70	72.21		72.46	0.001898	4.02	285.98	47.79	0.29
three	470	1800.00	62.70	74.67		74.97	0.001690	4.35	413.76	55.70	0.28
three	470	2000.00	62.70	75.25		75.56	0.001699	4.48	446.18	57.54	0.28
three	470	4740.00	62.70	82.01		82.38	0.001143	5.00	1004.38	109.00	0.25
three	470	6000.00	62.70	84.70		85.05	0.000892	4.91	1296.93	109.00	0.22
three	362	400.00	63.30	68.21		68.37	0.002226	3.21	124.63	33.00	0.29
three	362	600.00	63.30	69.62		69.81	0.001943	3.45	173.98	36.81	0.28

HEC-RAS Plan: Plan 37 River: upper penitencia Reach: three (Continued)

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
three	362	1150.00	63.30	71.95		72.24	0.002211	4.30	267.38	44.19	0.31
three	362	1800.00	63.30	74.43		74.77	0.002020	4.63	389.13	53.78	0.30
three	362	2000.00	63.30	75.00		75.35	0.002039	4.76	420.08	55.96	0.31
three	362	4740.00	63.30	81.90		82.26	0.001147	4.98	1014.78	108.00	0.25
three	362	6000.00	63.30	84.61		84.95	0.000883	4.85	1307.64	108.00	0.22
three	252	400.00	61.80	67.98		68.13	0.002029	3.16	126.62	31.83	0.28
three	252	600.00	61.80	69.42		69.60	0.001847	3.42	175.34	35.96	0.27
three	252	1150.00	61.80	71.70		71.99	0.002188	4.34	264.95	42.52	0.31
three	252	1800.00	61.80	74.19		74.54	0.002018	4.74	379.83	49.67	0.30
three	252	2000.00	61.80	74.75		75.12	0.002056	4.90	407.87	51.27	0.31
three	252	4740.00	61.80	81.72		82.12	0.001195	5.29	967.14	108.21	0.25
three	252	6000.00	61.80	84.48		84.85	0.000882	5.14	1274.86	114.00	0.22
three	145	400.00	59.80	67.83		67.95	0.001328	2.76	145.14	31.63	0.23
three	145	600.00	59.80	69.27		69.42	0.001373	3.09	194.02	36.28	0.24
three	145	1150.00	59.80	71.53		71.75	0.001930	3.74	308.99	61.30	0.29
three	145	1800.00	59.80	74.11		74.34	0.001269	3.81	483.34	74.16	0.24
three	145	2000.00	59.80	74.68		74.91	0.001211	3.91	526.39	77.32	0.24
three	145	4740.00	59.80	81.75		81.98	0.000584	4.12	1293.24	134.32	0.19
three	145	6000.00	59.80	84.51		84.73	0.000443	4.01	1673.19	139.00	0.17
three	135	400.00	59.00	67.83		67.94	0.001126	2.62	152.48	28.45	0.20
three	135	600.00	59.00	69.26		69.41	0.001274	3.09	194.29	29.50	0.21
three	135	1150.00	59.00	71.41		71.72	0.002098	4.46	257.71	29.50	0.27
three	135	1800.00	59.00	73.83		74.29	0.002623	5.47	328.96	29.50	0.29
three	135	2000.00	59.00	74.34		74.86	0.002866	5.81	344.12	29.50	0.30
three	135	4740.00	59.00	80.61		81.86	0.005190	8.96	529.12	29.50	0.37
three	135	6000.00	59.00	83.03		84.58	0.006032	9.99	600.45	29.50	0.39
three	134	400.00	59.00	67.83	63.22	67.93	0.001127	2.62	152.42	28.44	0.20
three	134	600.00	59.00	69.26	64.17	69.41	0.001276	3.09	194.23	29.50	0.21
three	134	1150.00	59.00	71.41	65.97	71.72	0.002100	4.46	257.61	29.50	0.27
three	134	1800.00	59.00	73.82	67.39	74.29	0.002625	5.47	328.84	29.50	0.29
three	134	2000.00	59.00	74.34	67.81	74.86	0.002869	5.81	343.99	29.50	0.30
three	134	4740.00	59.00	80.60	71.98	81.85	0.005197	8.96	528.85	29.50	0.37
three	134	6000.00	59.00	83.02	73.55	84.57	0.006041	10.00	600.11	29.50	0.39
three	108.5	Culvert									
three	83	400.00	59.10	62.52	62.52	63.62	0.031075	8.42	47.53	21.87	1.01
three	83	600.00	59.10	63.24	63.24	64.60	0.029645	9.36	64.08	23.92	1.01
three	83	1150.00	59.10	65.00	64.81	66.68	0.023523	10.40	110.58	28.92	0.94
three	83	1800.00	59.10	68.00	66.18	69.22	0.009974	8.86	203.15	31.20	0.61
three	83	2000.00	59.10	68.00	66.52	69.51	0.012314	9.84	203.15	31.20	0.68
three	83	4740.00	59.10	71.00	70.44	74.96	0.023627	15.97	296.75	31.20	0.91
three	83	6000.00	59.10	73.00	71.96	77.33	0.022428	16.71	359.15	31.20	0.87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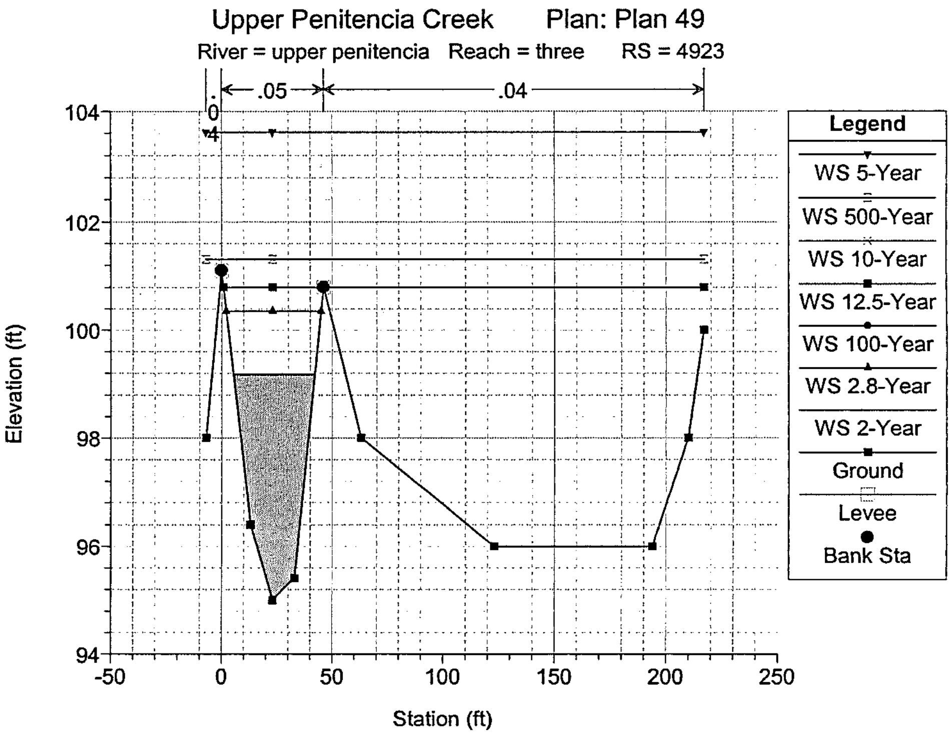
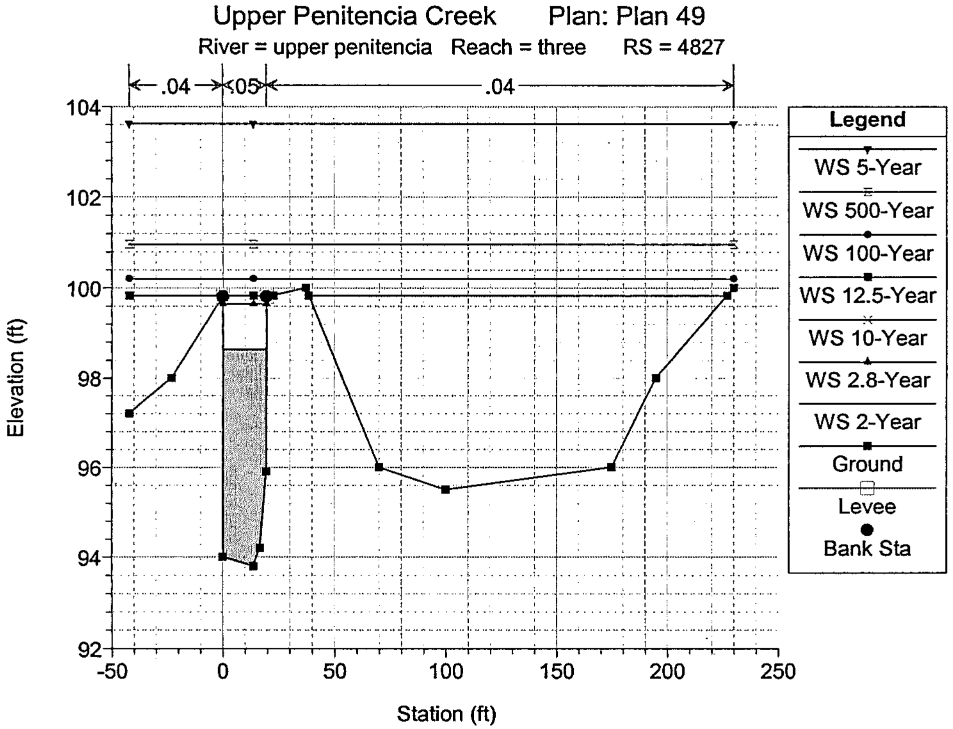
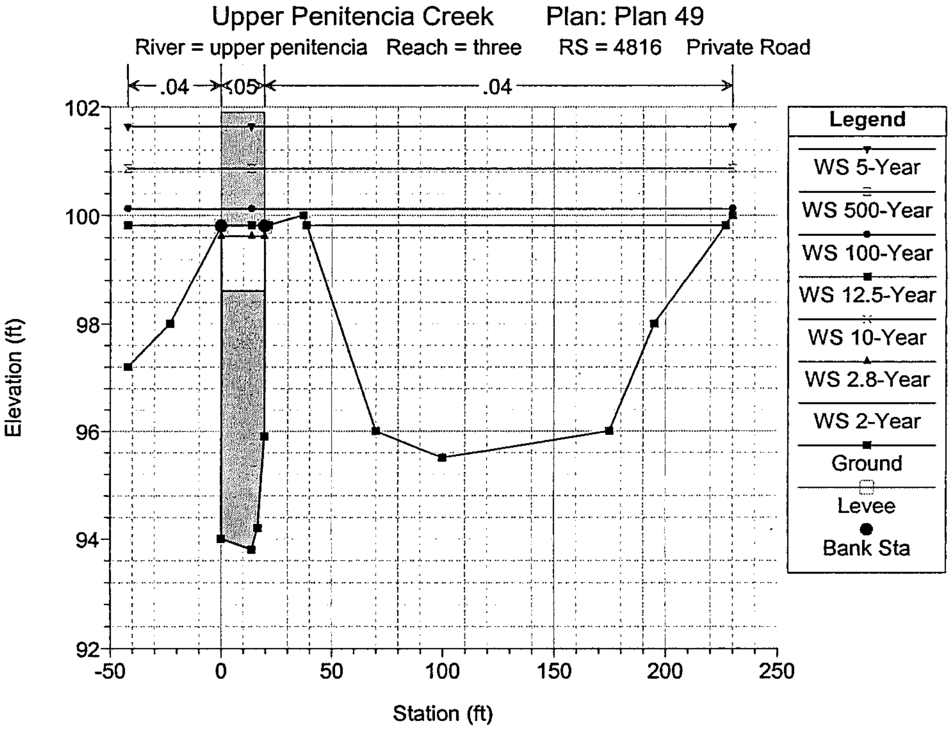
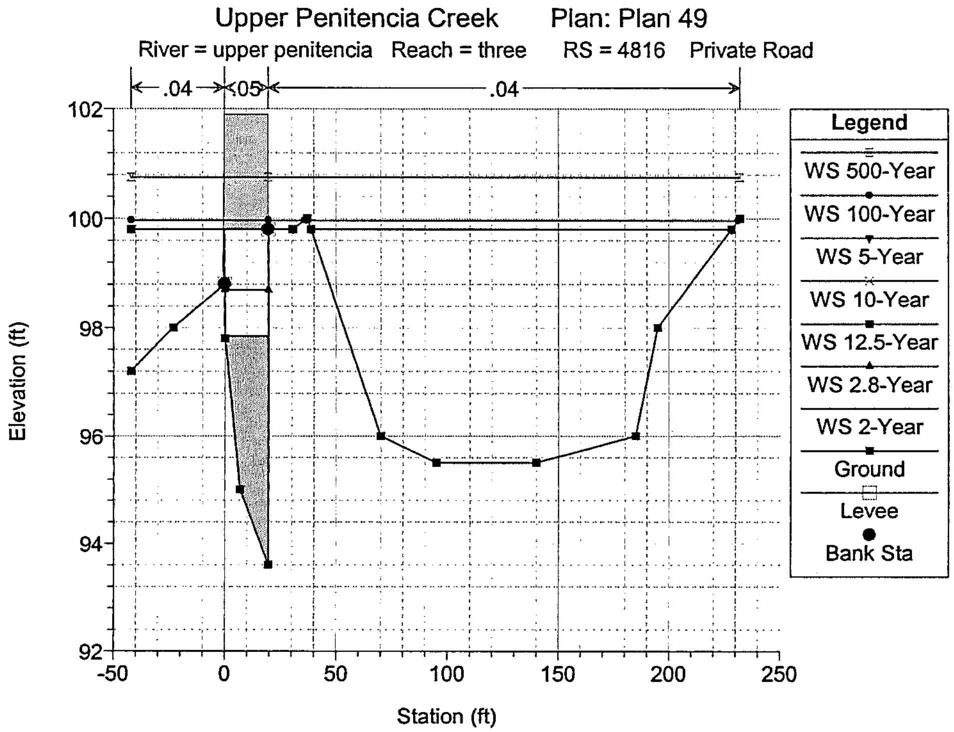
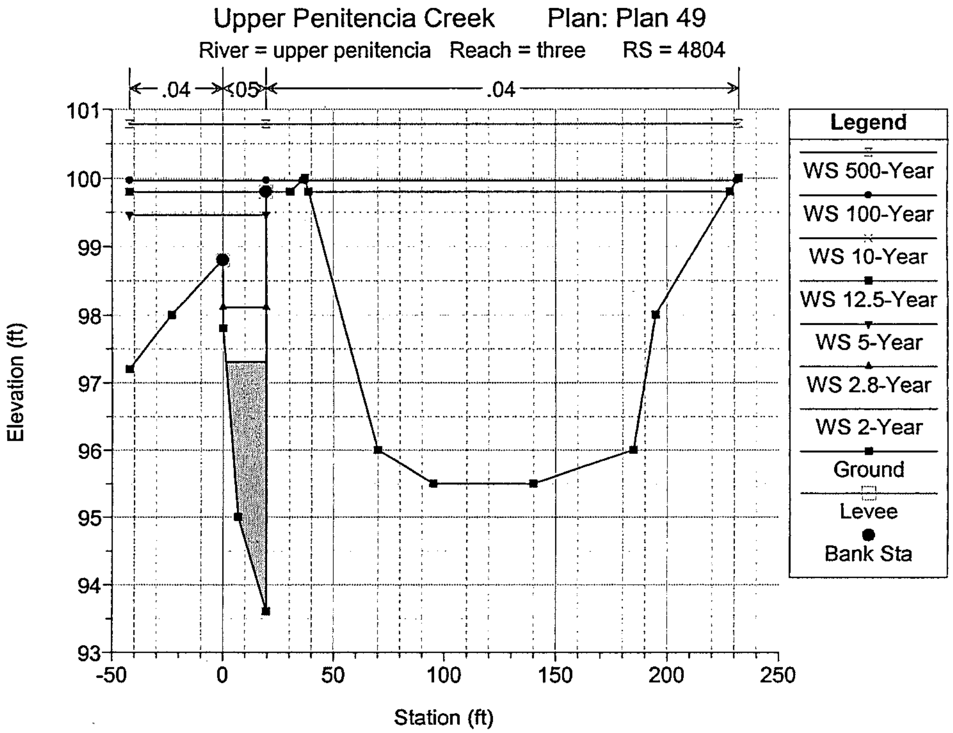
River = upper penitencia Reach = three RS = 5052
.04
.05
.04
Legend
WS 5-Year
WS 100-Year
WS 500-Year
WS 10-Year
WS 12.5-Year
WS 2.8-Year
WS 2-Year
Ground
Levee
Bank Sta
Elevation (ft)
104
102
100
98
96
94
Station (ft)
-50
0
50
100
150
200
250


Upper Penitencia Creek Plan: Plan 49
River = upper penitencia Reach = three RS = 4923
.0
4
.05
.04
Legend
WS 5-Year
WS 500-Year
WS 10-Year
WS 12.5-Year
WS 100-Year
WS 2.8-Year
WS 2-Year
Ground
Levee
Bank Sta
Elevation (ft)
104
102
100
98
96
94
Station (ft)
-50
0
50
100
150
200
250


Upper Penitencia Creek Plan: Plan 49
River = upper penitencia Reach = three RS = 4827
.04
05
.04
Legend
WS 5-Year
WS 500-Year
WS 100-Year
WS 12.5-Year
WS 10-Year
WS 2.8-Year
WS 2-Year
Ground
Levee
Bank Sta
Elevation (ft)
104
102
100
98
96
94
92
Station (ft)
-50
0
50
100
150
200
250


Upper Penitencia Creek Plan: Plan 49
River = upper penitencia Reach = three RS = 4816 Private Road
.04
05
.04
Legend
WS 5-Year
WS 500-Year
WS 100-Year
WS 12.5-Year
WS 10-Year
WS 2.8-Year
WS 2-Year
Ground
Levee
Bank Sta
Elevation (ft)
102
100
98
96
94
92
Station (ft)
-50
0
50
100
150
200
250


Upper Penitencia Creek Plan: Plan 49
River = upper penitencia Reach = three RS = 4816 Private Road


Upper Penitencia Creek Plan: Plan 49
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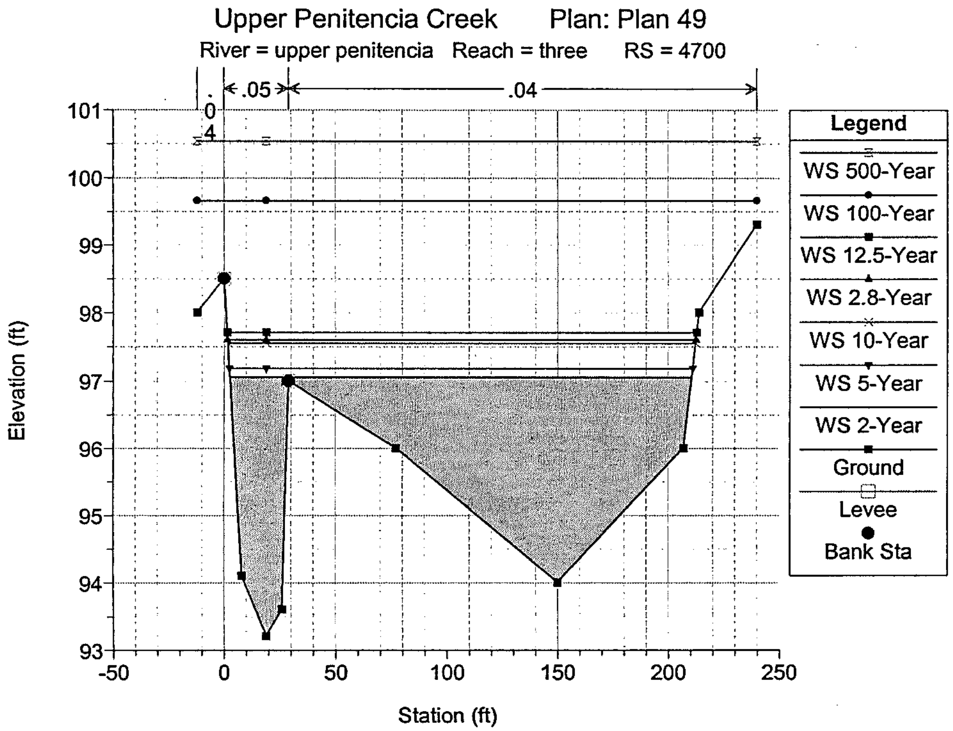
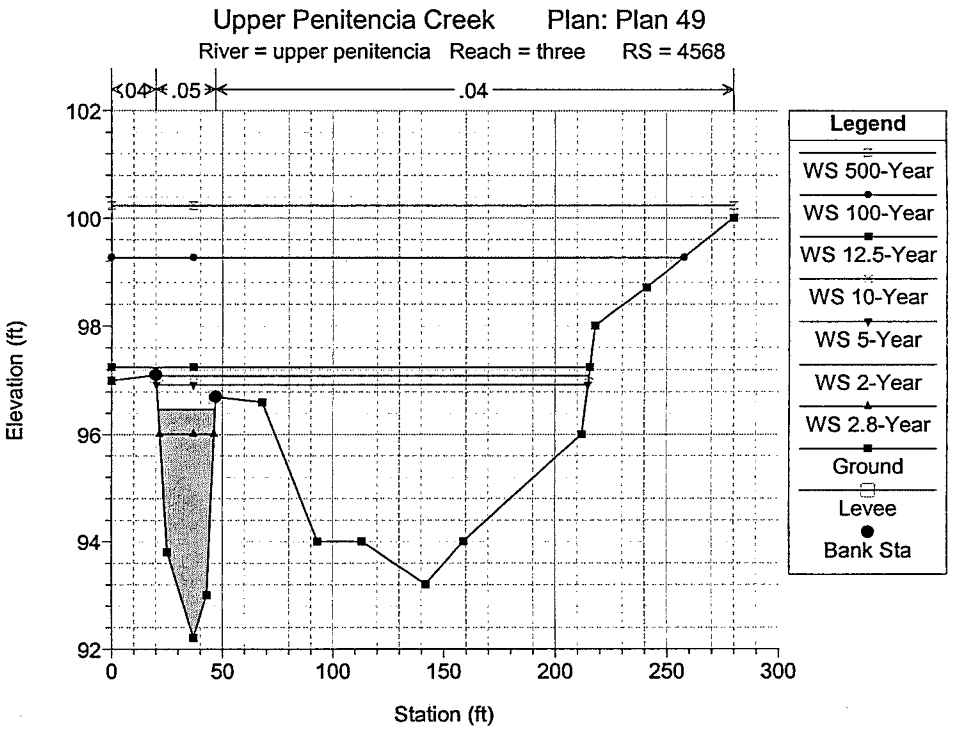
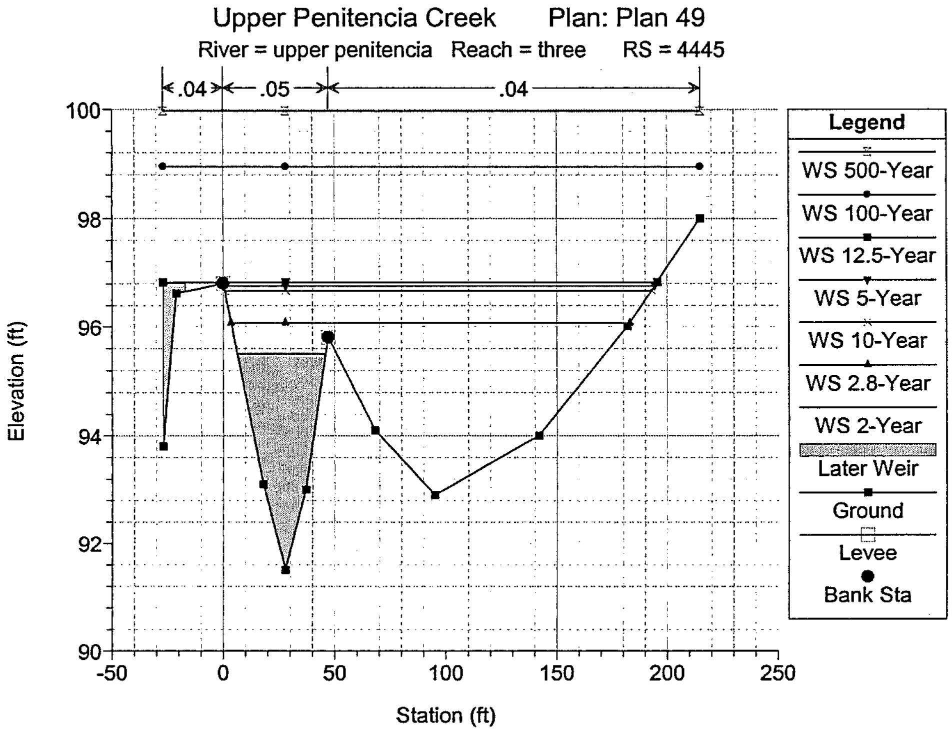
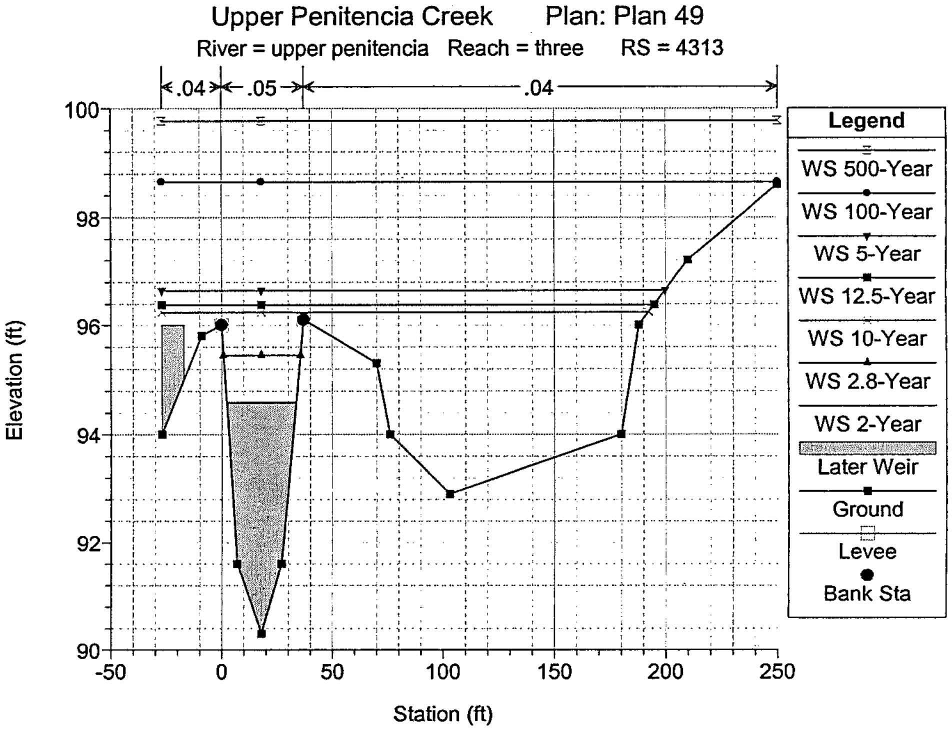
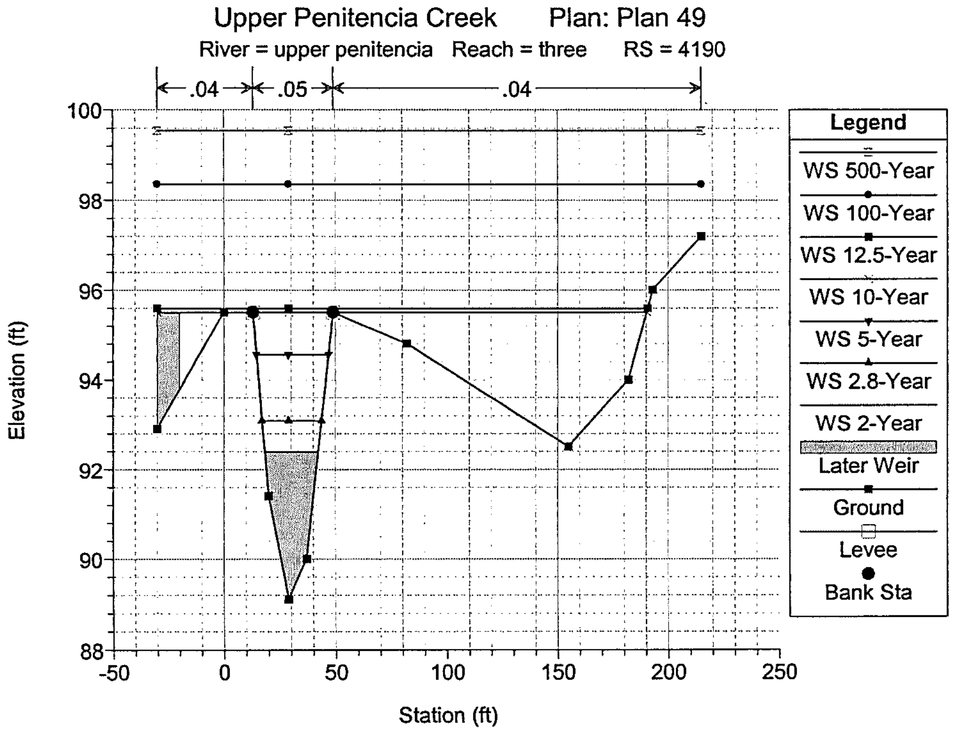
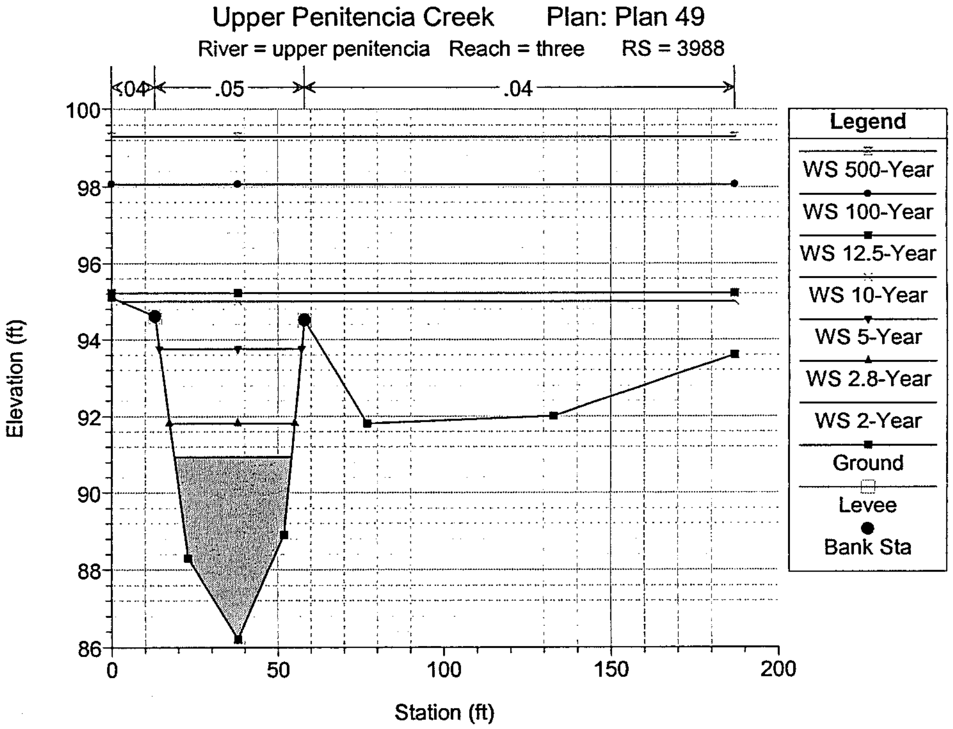

Upper Penitencia Creek Plan: Plan 49
River = upper penitencia Reach = three RS = 4700

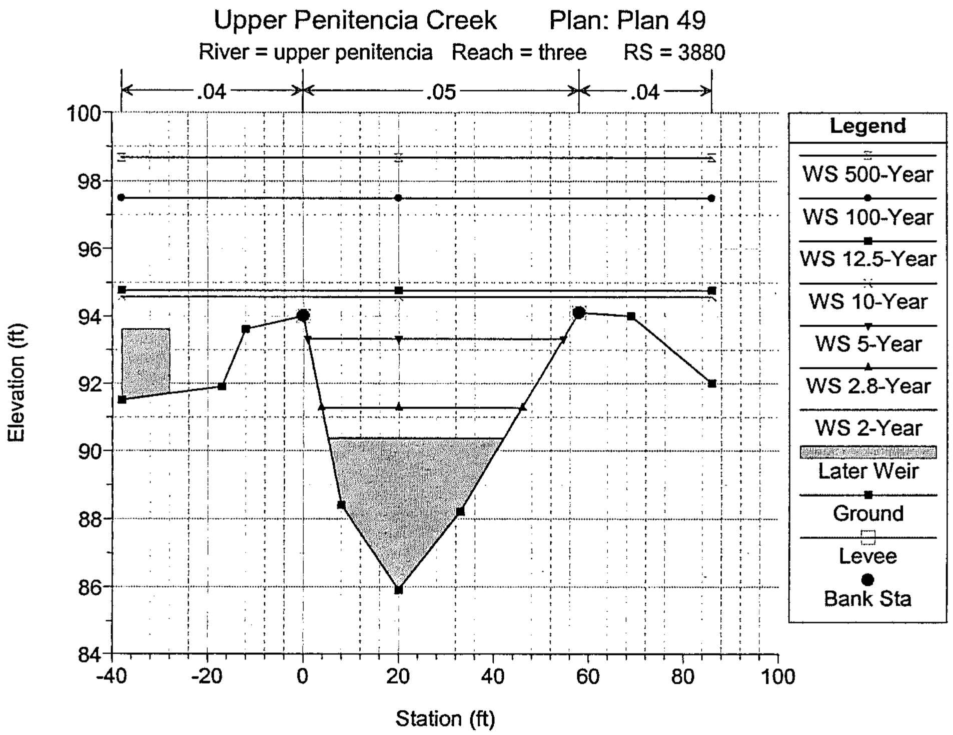

Upper Penitencia Creek Plan: Plan 49
River = upper penitencia Reach = three RS = 4568

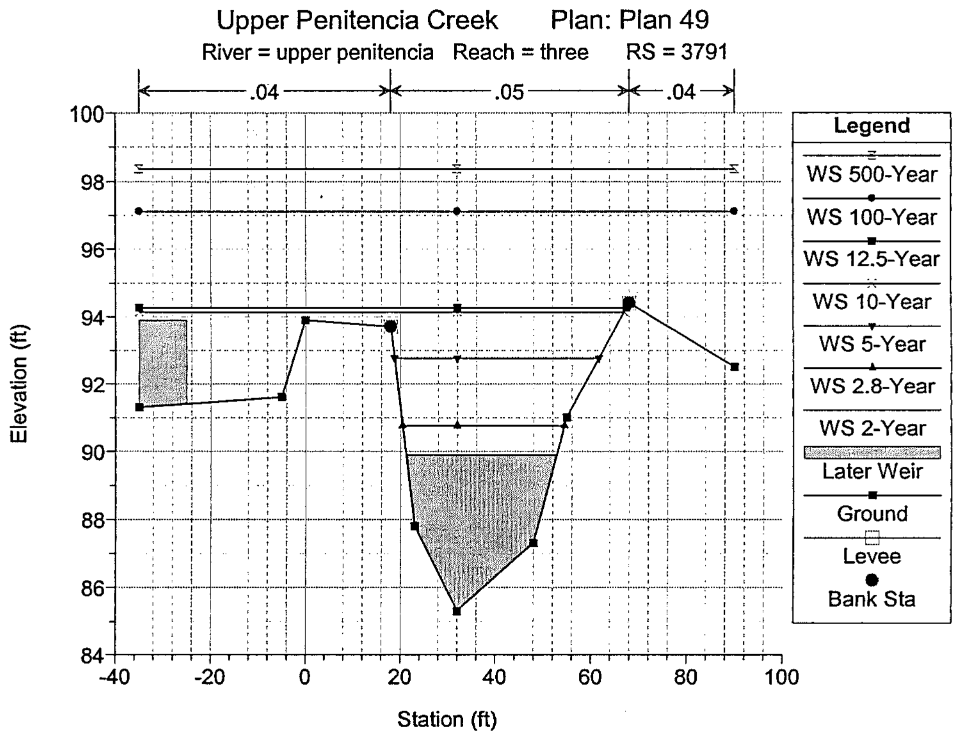

Upper Penitencia Creek Plan: Plan 49
River = upper penitencia Reach = three RS = 4445

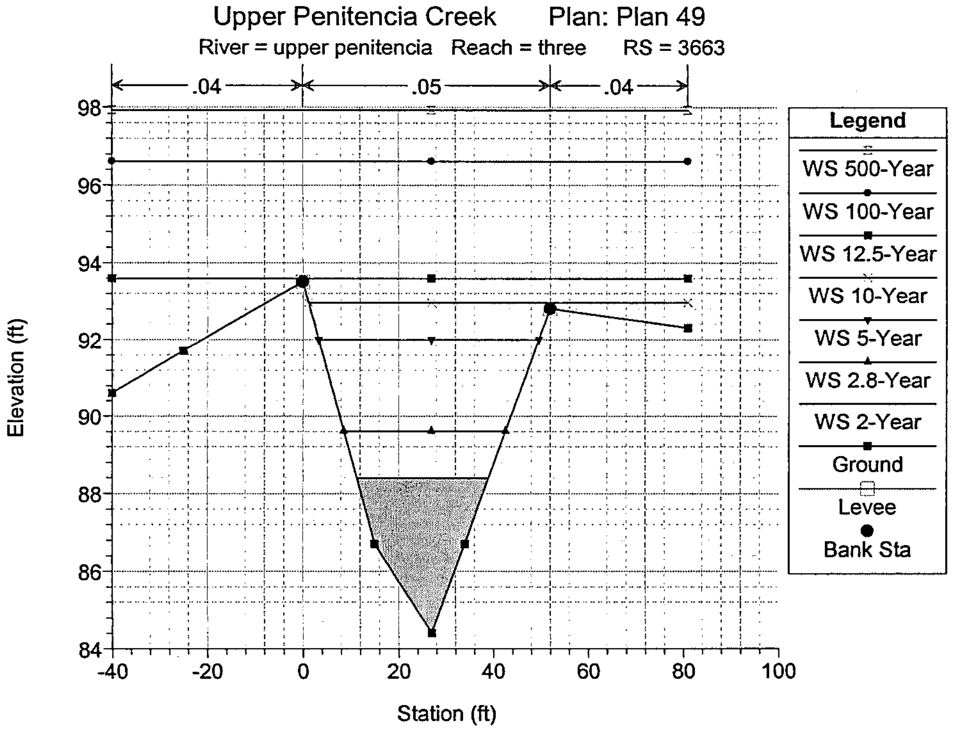

Upper Penitencia Creek Plan: Plan 49
River = upper penitencia Reach = three RS = 4313

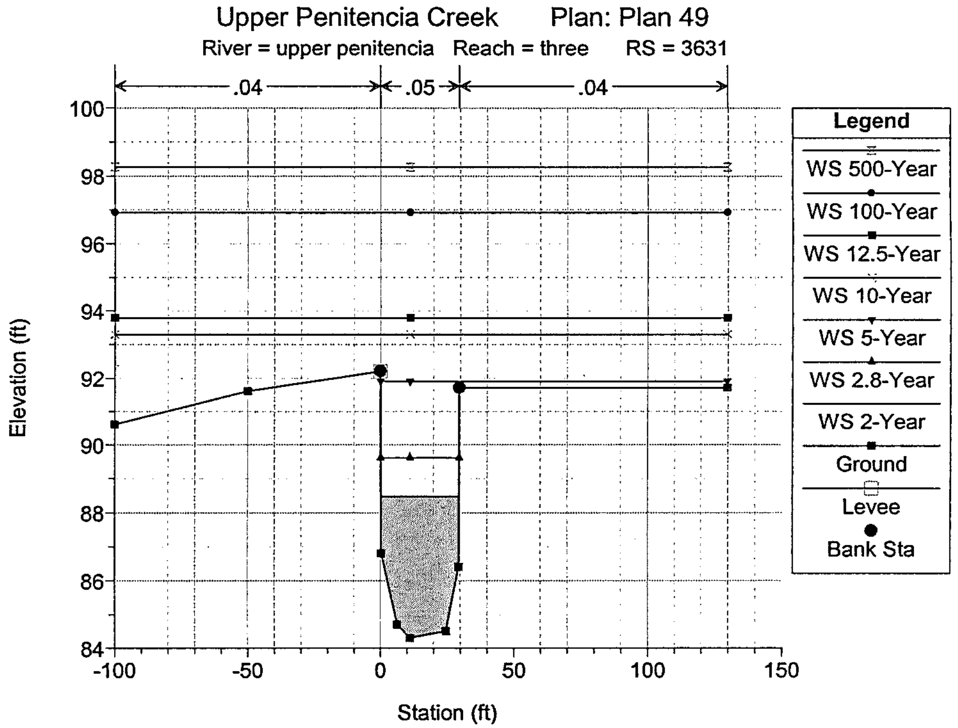

Upper Penitencia Creek Plan: Plan 49
River = upper penitencia Reach = three RS = 4190

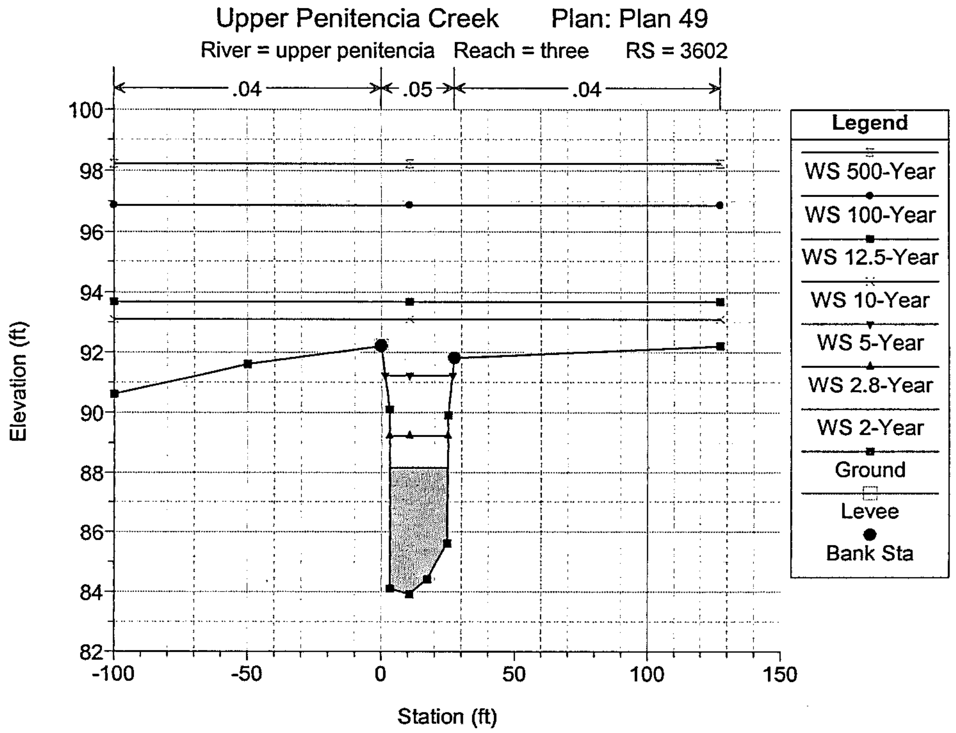

Upper Penitencia Creek Plan: Plan 49
River = upper penitencia Reach = three RS = 3988

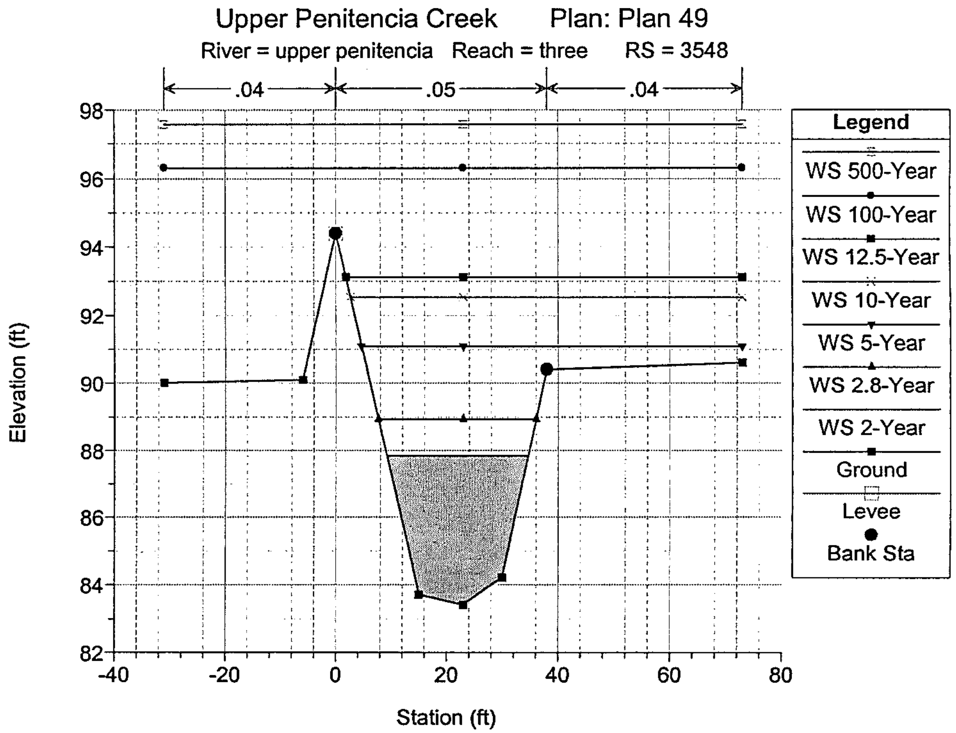

Upper Penitencia Creek Plan: Plan 49
River = upper penitencia Reach = three RS = 3880

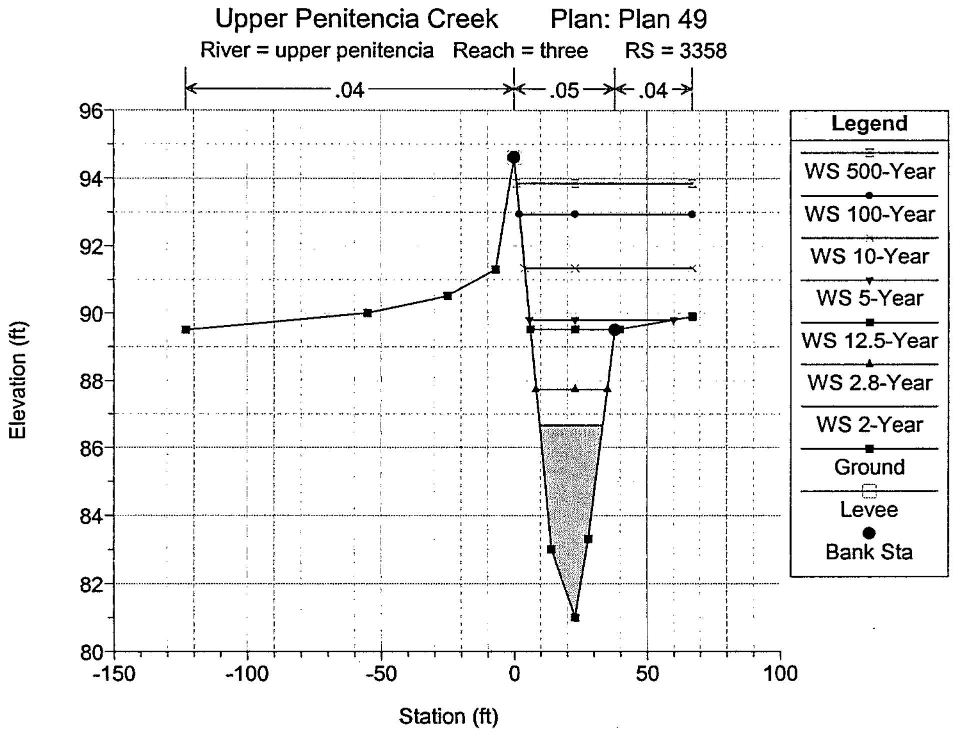

Upper Penitencia Creek Plan: Plan 49
River = upper penitencia Reach = three RS = 3791

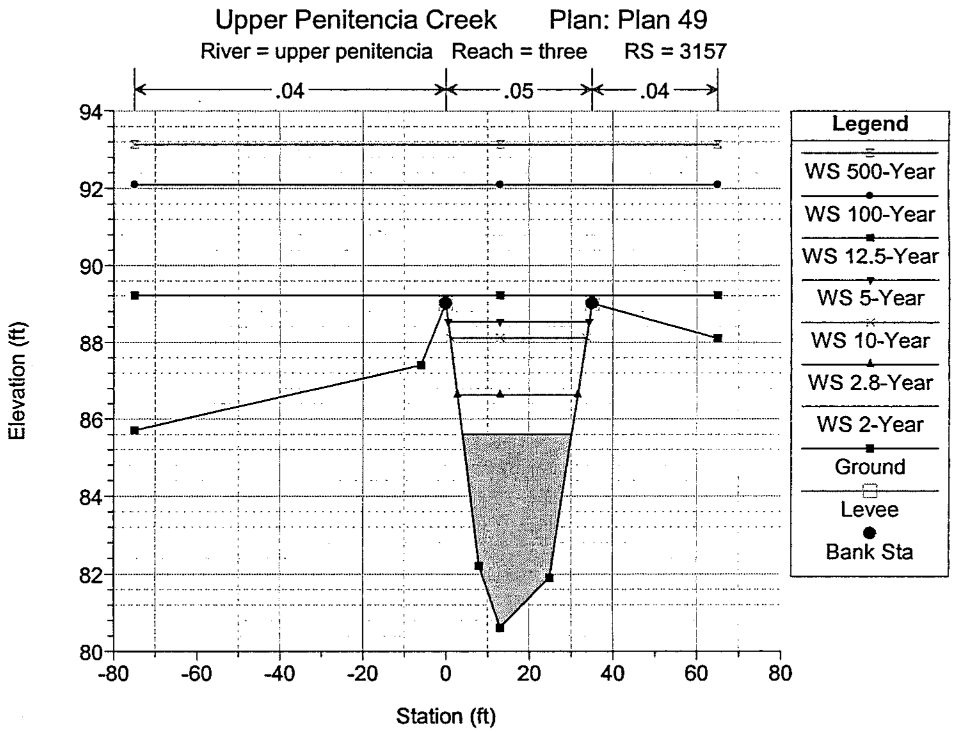

Upper Penitencia Creek Plan: Plan 49
River = upper penitencia Reach = three RS = 3663

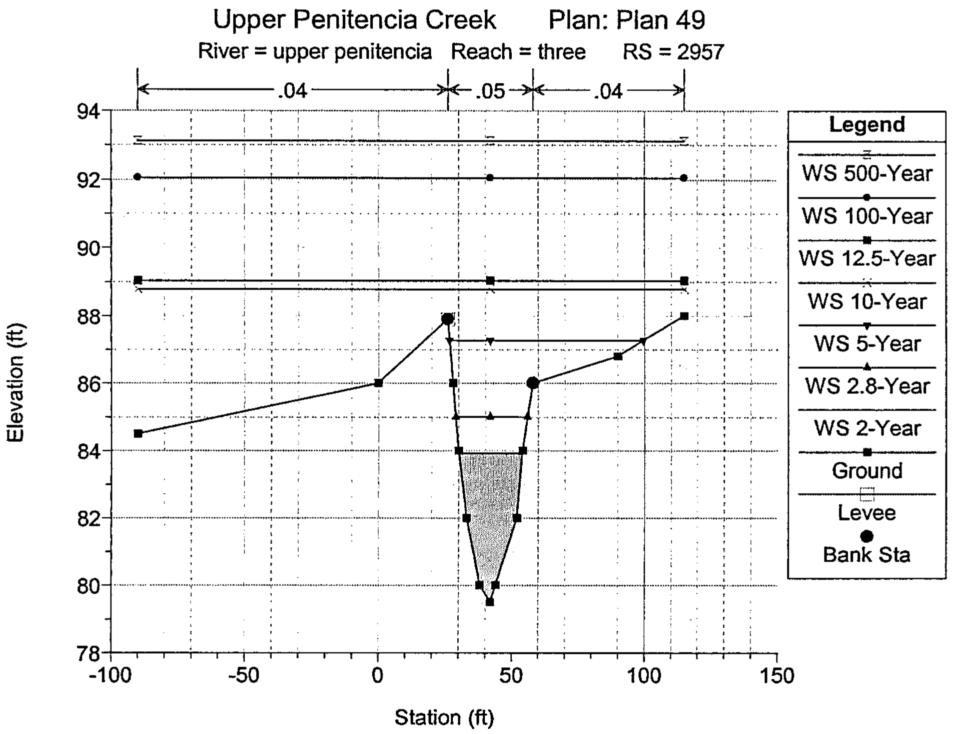

Upper Penitencia Creek Plan: Plan 49
River = upper penitencia Reach = three RS = 3631

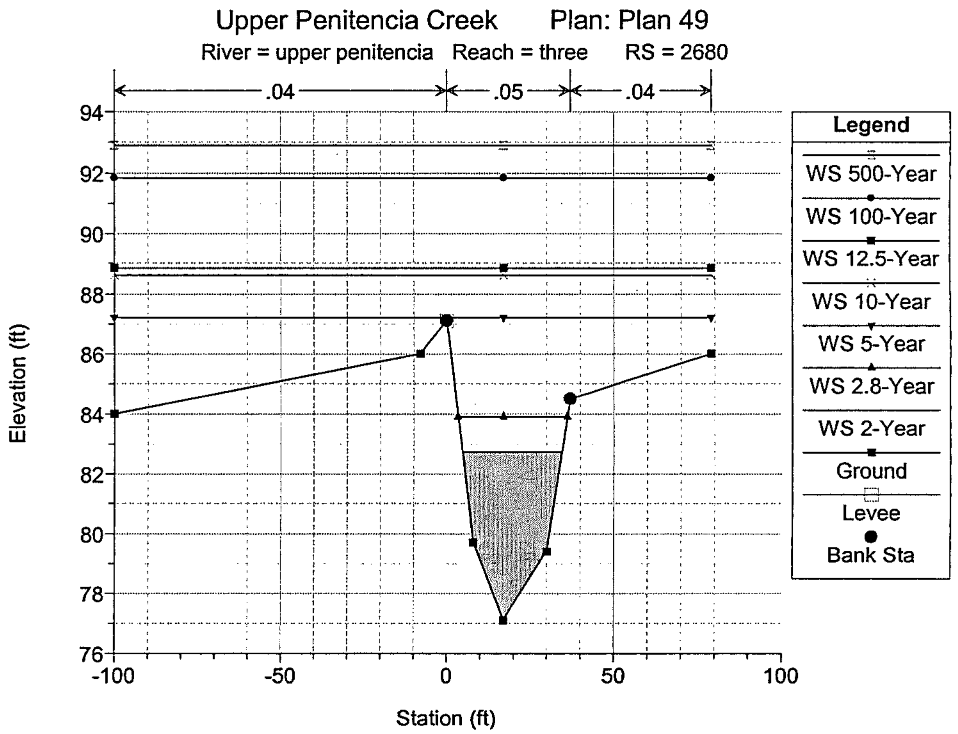

Upper Penitencia Creek Plan: Plan 49
River = upper penitencia Reach = three RS = 3602
.04
.05
.04
Elevation (ft)
100
98
96
94
92
90
88
86
84
82
-100
-50
0
50
100
150
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 12.5-Year
WS 10-Year
WS 5-Year
WS 2.8-Year
WS 2-Year
Ground
Levee
Bank Sta

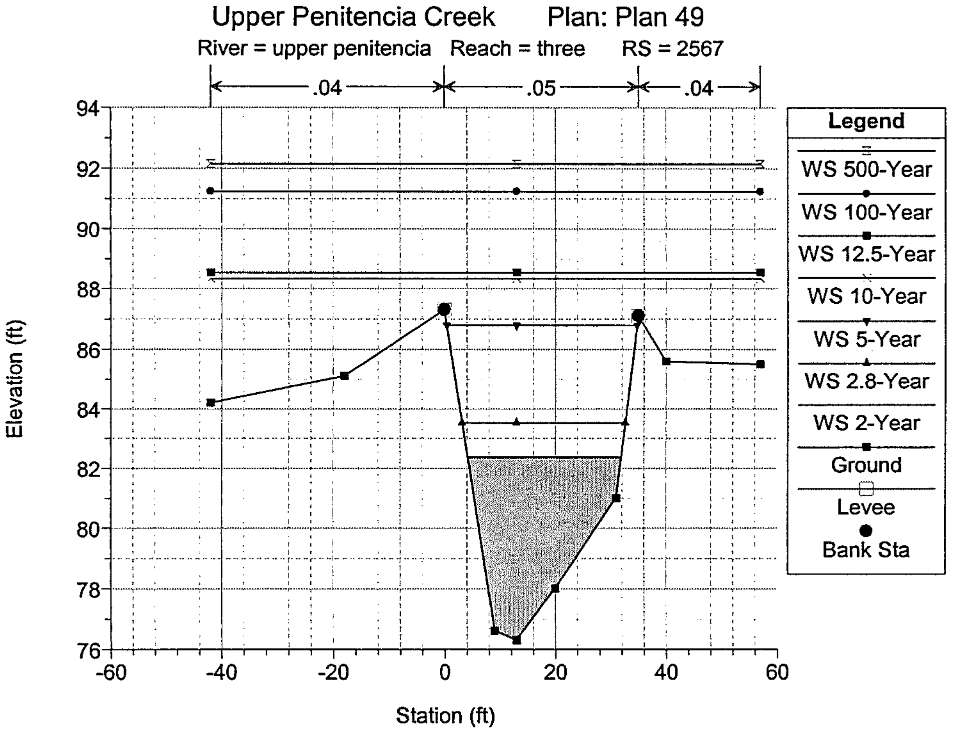

Upper Penitencia Creek Plan: Plan 49
River = upper penitencia Reach = three RS = 3548
.04
.05
.04
Elevation (ft)
98
96
94
92
90
88
86
84
82
-40
-20
0
20
40
60
80
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 12.5-Year
WS 10-Year
WS 5-Year
WS 2.8-Year
WS 2-Year
Ground
Levee
Bank Sta

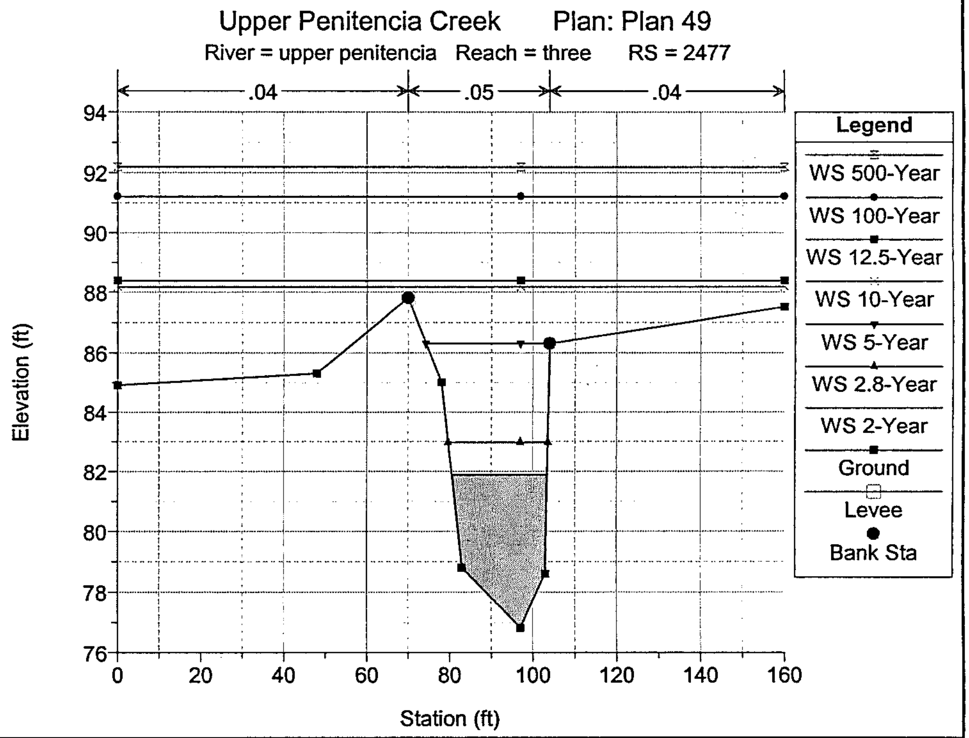

Upper Penitencia Creek Plan: Plan 49
River = upper penitencia Reach = three RS = 3358
.04
.05
.04
Elevation (ft)
96
94
92
90
88
86
84
82
80
-150
-100
-50
0
50
100
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 10-Year
WS 5-Year
WS 12.5-Year
WS 2.8-Year
WS 2-Year
Ground
Levee
Bank Sta

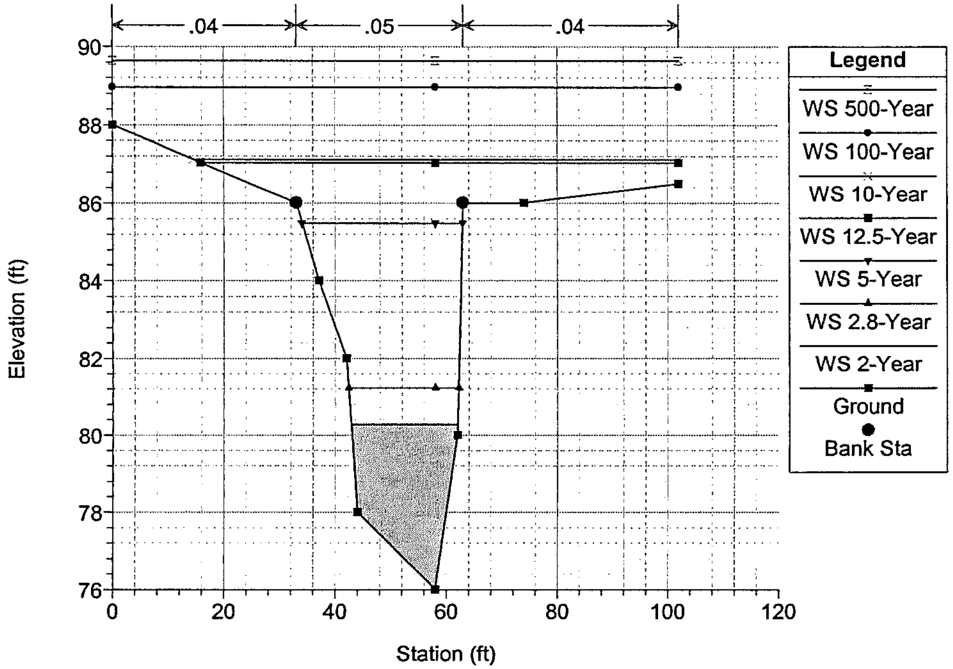

Upper Penitencia Creek Plan: Plan 49
River = upper penitencia Reach = three RS = 3157
.04
.05
.04
Elevation (ft)
94
92
90
88
86
84
82
80
-80
-60
-40
-20
0
20
40
60
80
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 12.5-Year
WS 5-Year
WS 10-Year
WS 2.8-Year
WS 2-Year
Ground
Levee
Bank Sta

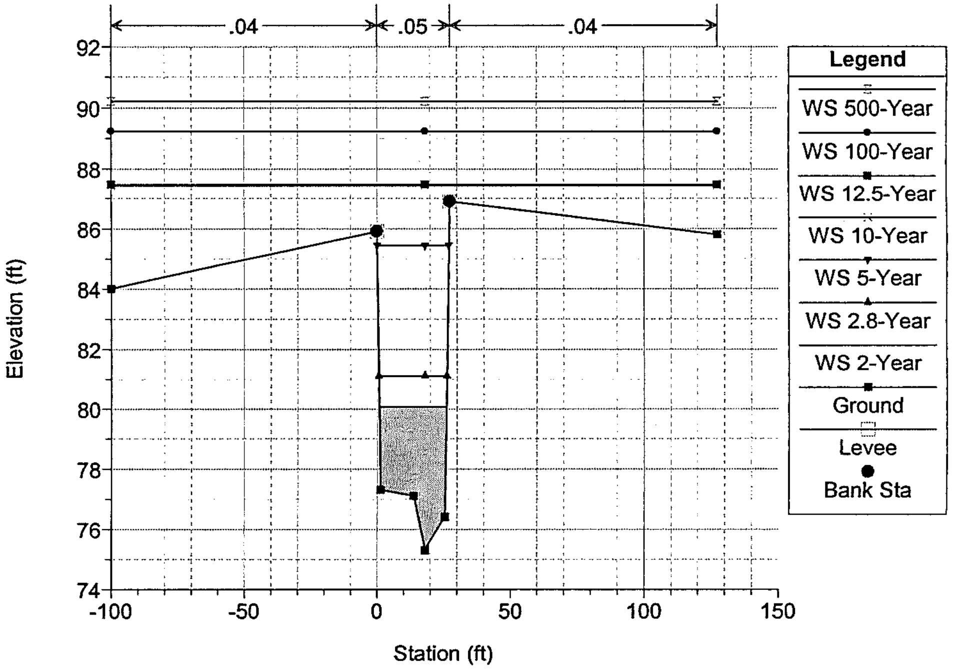

Upper Penitencia Creek Plan: Plan 49
River = upper penitencia Reach = three RS = 2957
.04
.05
.04
94
92
90
88
86
84
82
80
78
Elevation (ft)
-100
-50
0
50
100
150
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 12.5-Year
WS 10-Year
WS 5-Year
WS 2.8-Year
WS 2-Year
Ground
Levee
Bank Sta

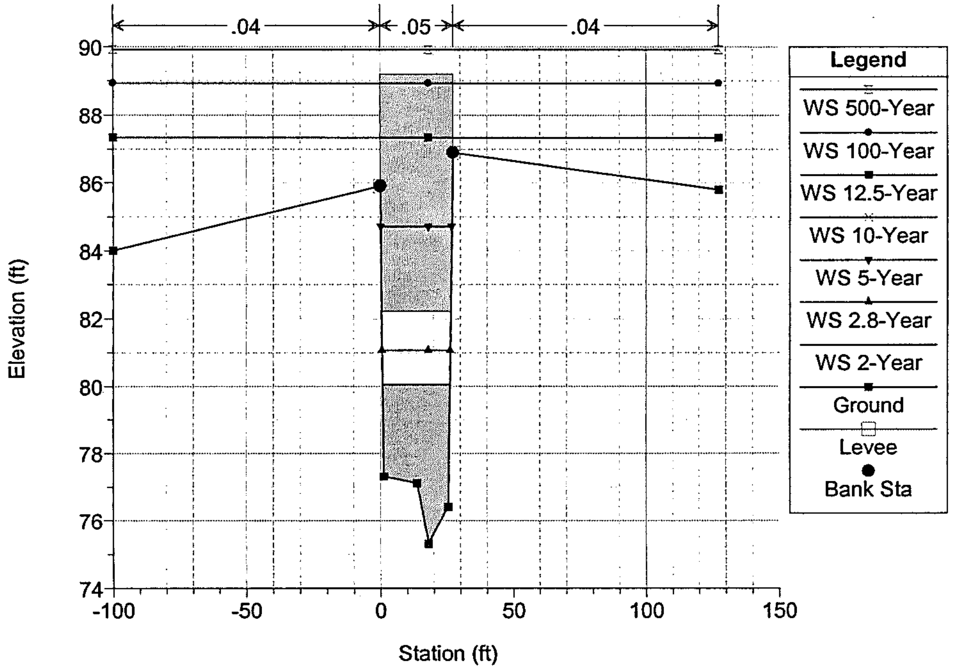

Upper Penitencia Creek Plan: Plan 49
River = upper penitencia Reach = three RS = 2680
.04
.05
.04
94
92
90
88
86
84
82
80
78
76
Elevation (ft)
-100
-50
0
50
100
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 12.5-Year
WS 10-Year
WS 5-Year
WS 2.8-Year
WS 2-Year
Ground
Levee
Bank Sta

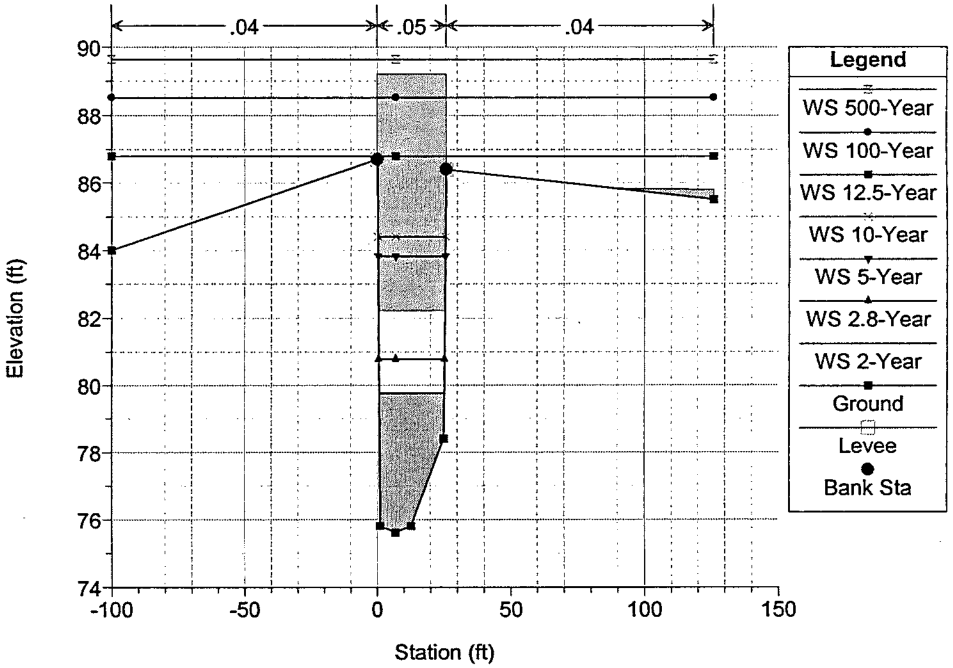

Upper Penitencia Creek Plan: Plan 49
River = upper penitencia Reach = three RS = 2567
.04
.05
.04
94
92
90
88
86
84
82
80
78
76
Elevation (ft)
-60
-40
-20
0
20
40
60
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 12.5-Year
WS 10-Year
WS 5-Year
WS 2.8-Year
WS 2-Year
Ground
Levee
Bank Sta

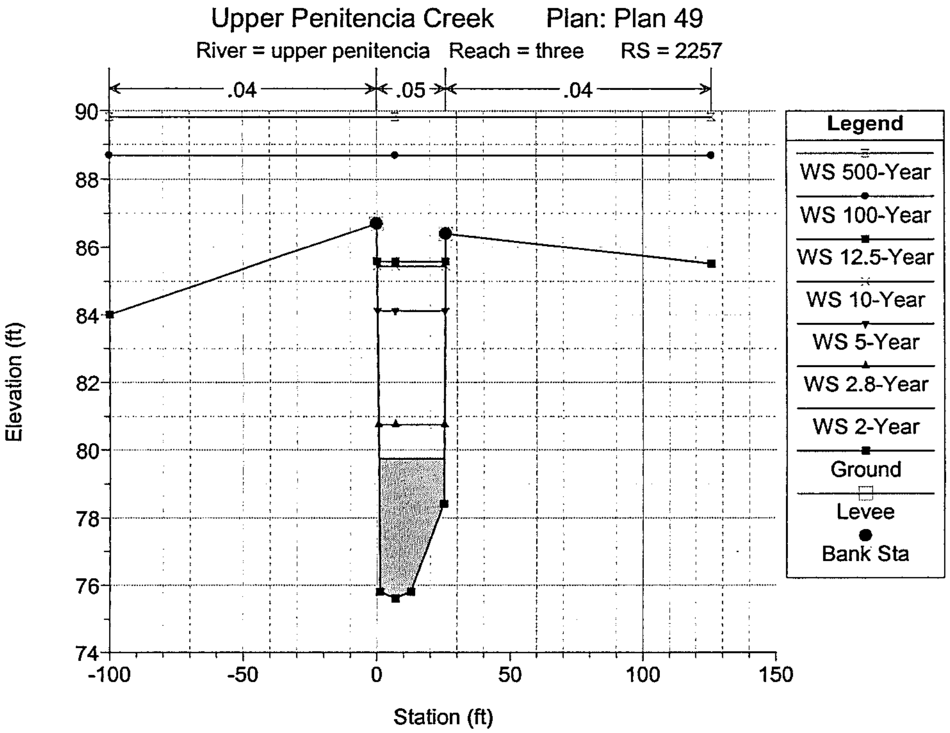

Upper Penitencia Creek Plan: Plan 49
River = upper penitencia Reach = three RS = 2477
.04
.05
.04
94
92
90
88
86
84
82
80
78
76
Elevation (ft)
0
20
40
60
80
100
120
140
160
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 12.5-Year
WS 10-Year
WS 5-Year
WS 2.8-Year
WS 2-Year
Ground
Levee
Bank Sta

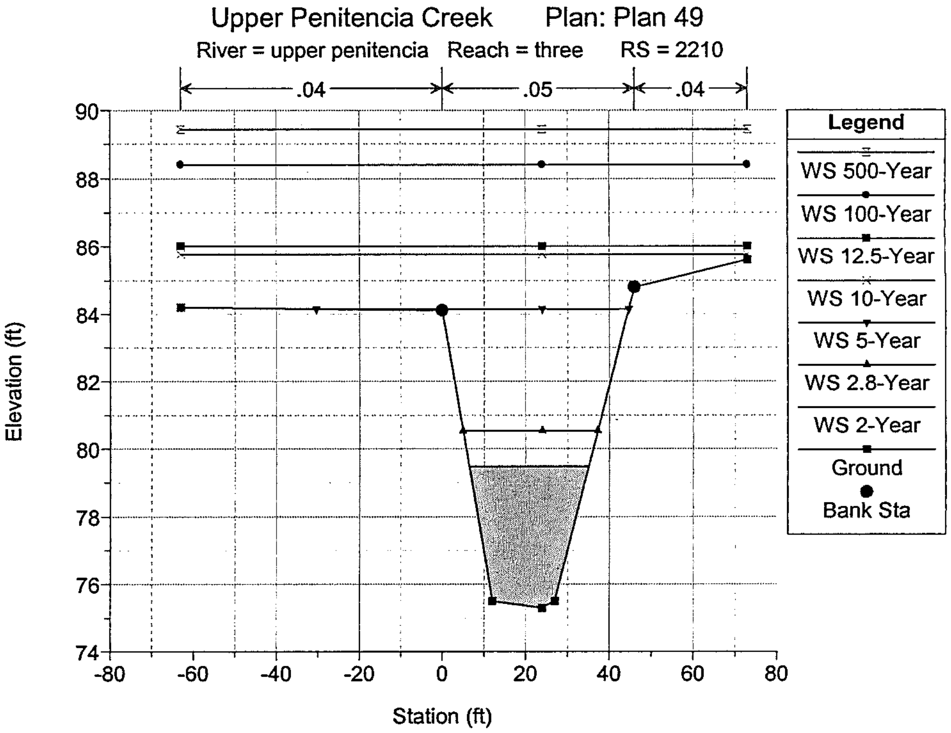

Upper Penitencia Creek Plan: Plan 49
River = upper penitencia Reach = three RS = 2350

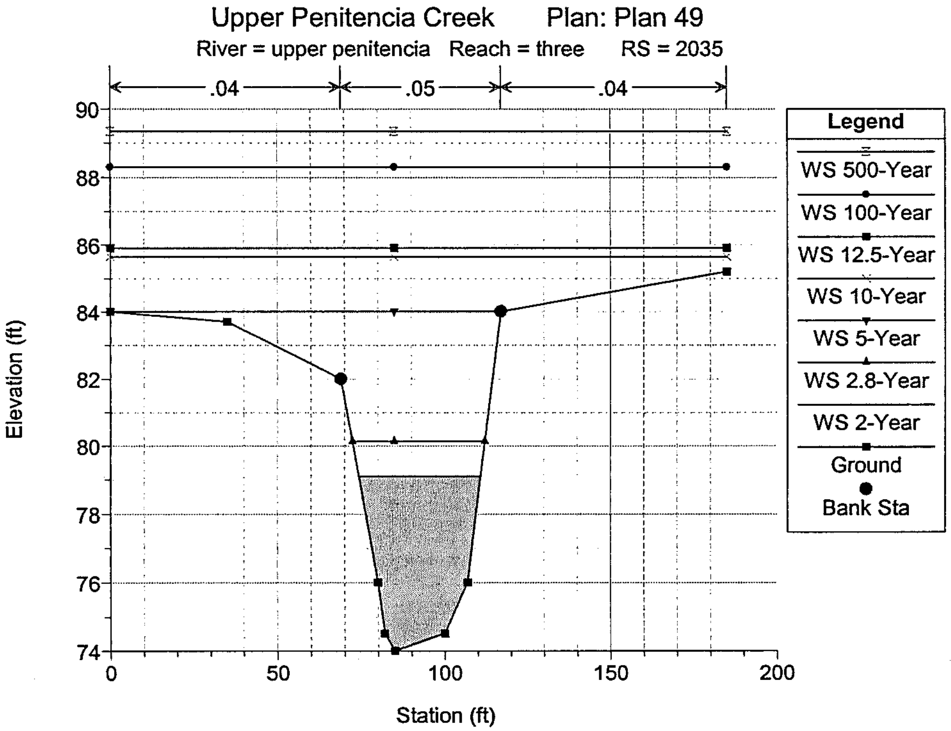

Upper Penitencia Creek Plan: Plan 49
River = upper penitencia Reach = three RS = 2298

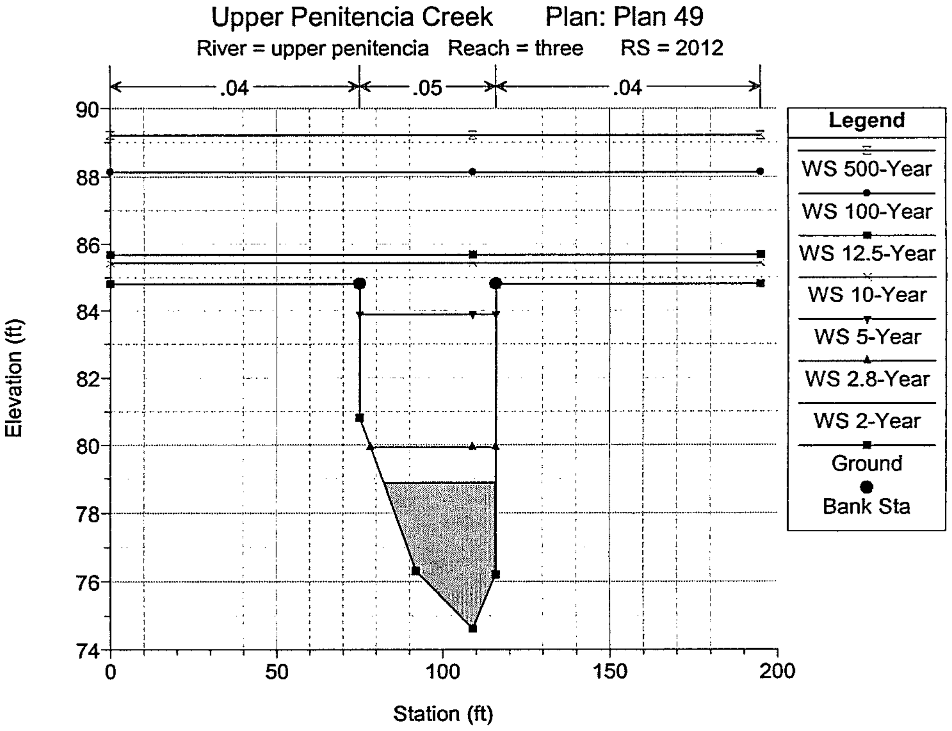

Upper Penitencia Creek Plan: Plan 49
River = upper penitencia Reach = three RS = 2272 Private Crossing


Upper Penitencia Creek Plan: Plan 49
River = upper penitencia Reach = three RS = 2272 Private Crossing

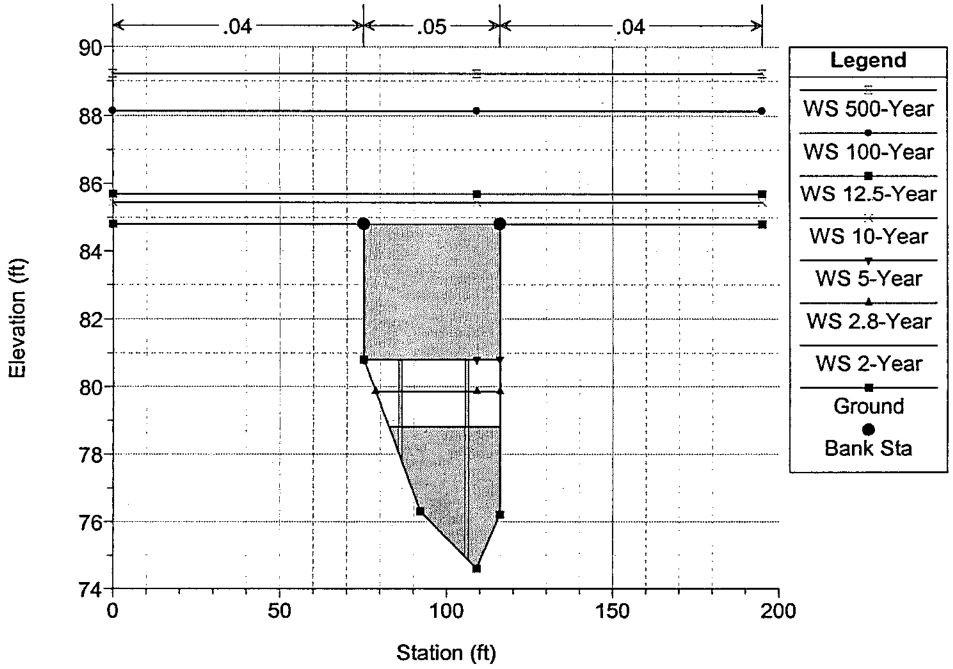

Upper Penitencia Creek Plan: Plan 49
River = upper penitencia Reach = three RS = 2257


Upper Penitencia Creek Plan: Plan 49
River = upper penitencia Reach = three RS = 2210

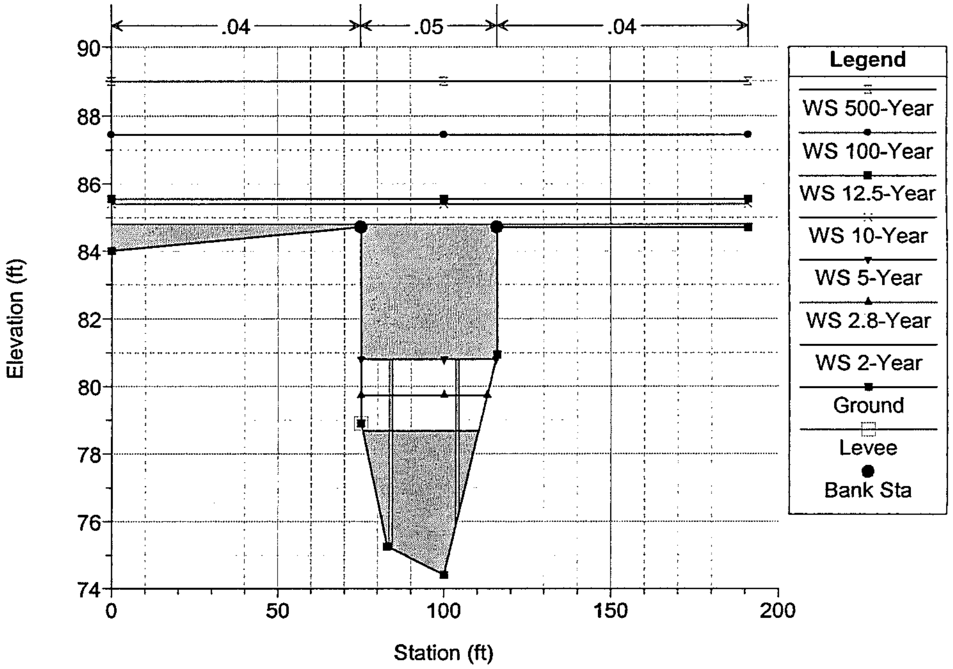

Upper Penitencia Creek Plan: Plan 49
River = upper penitencia Reach = three RS = 2035


Upper Penitencia Creek Plan: Plan 49
River = upper penitencia Reach = three RS = 2012

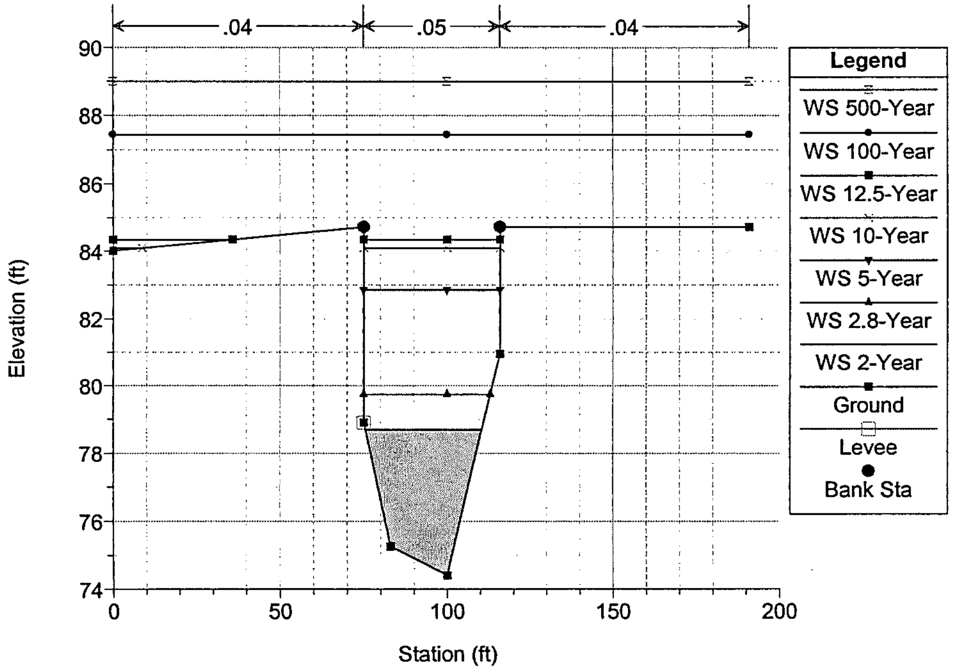
Upper Penitencia Creek Plan: Plan 49
River = upper penitencia Reach = three RS = 2000 Railroad Crossing



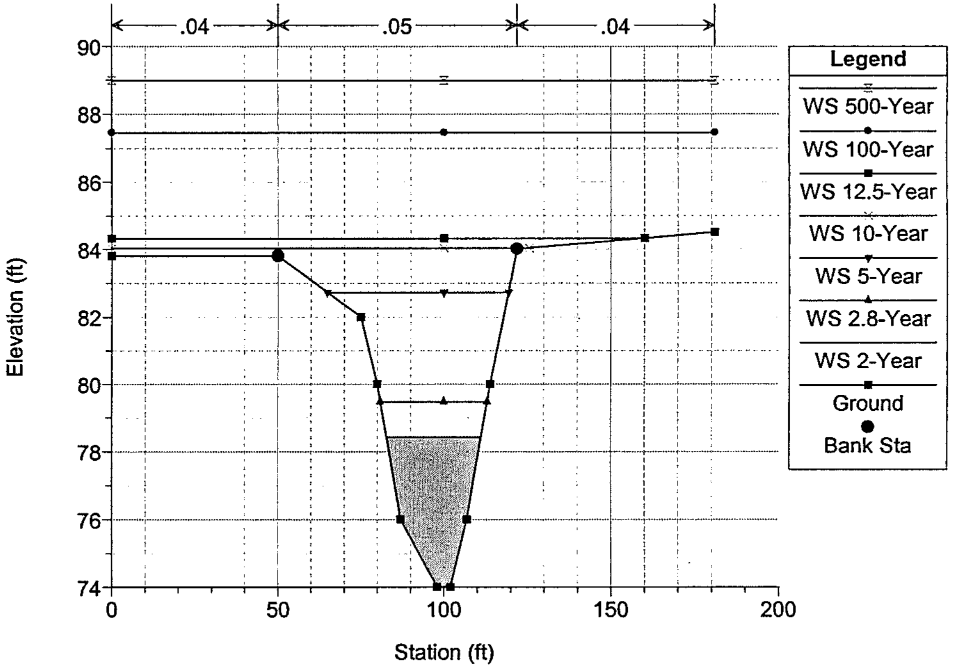
Upper Penitencia Creek Plan: Plan 49
River = upper penitencia Reach = three RS = 2000 Railroad Crossing

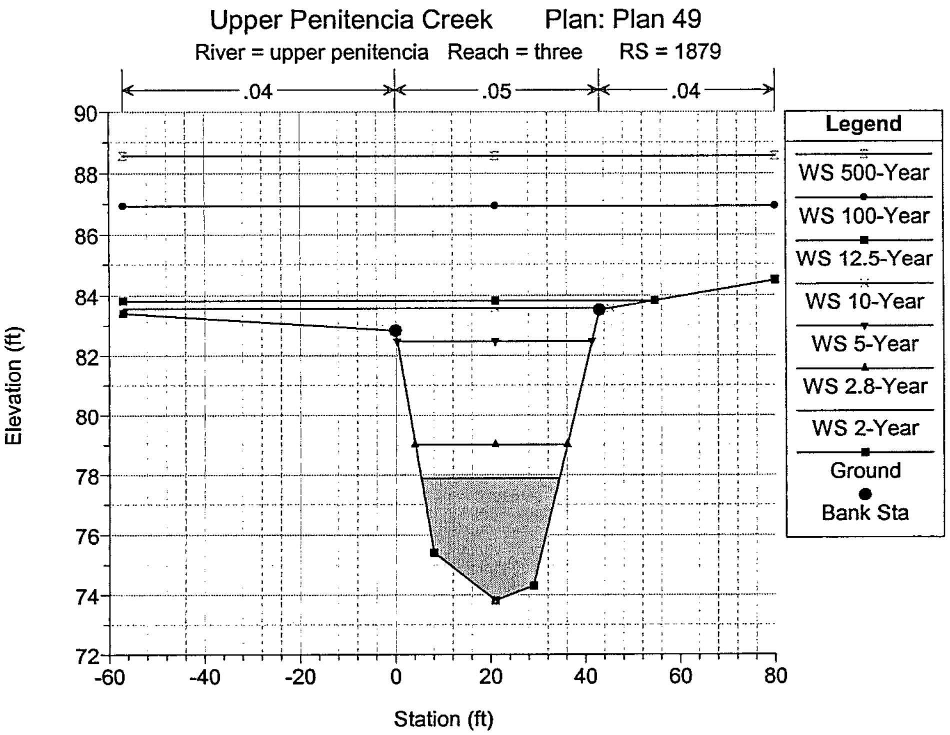


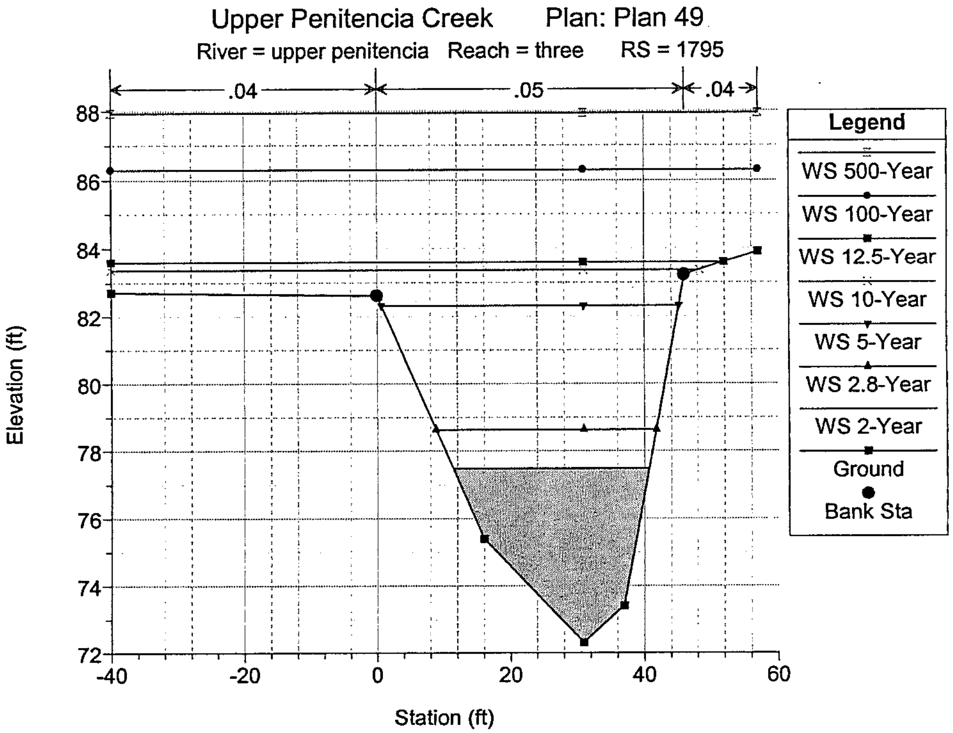
Upper Penitencia Creek Plan: Plan 49
River = upper penitencia Reach = three RS = 1988

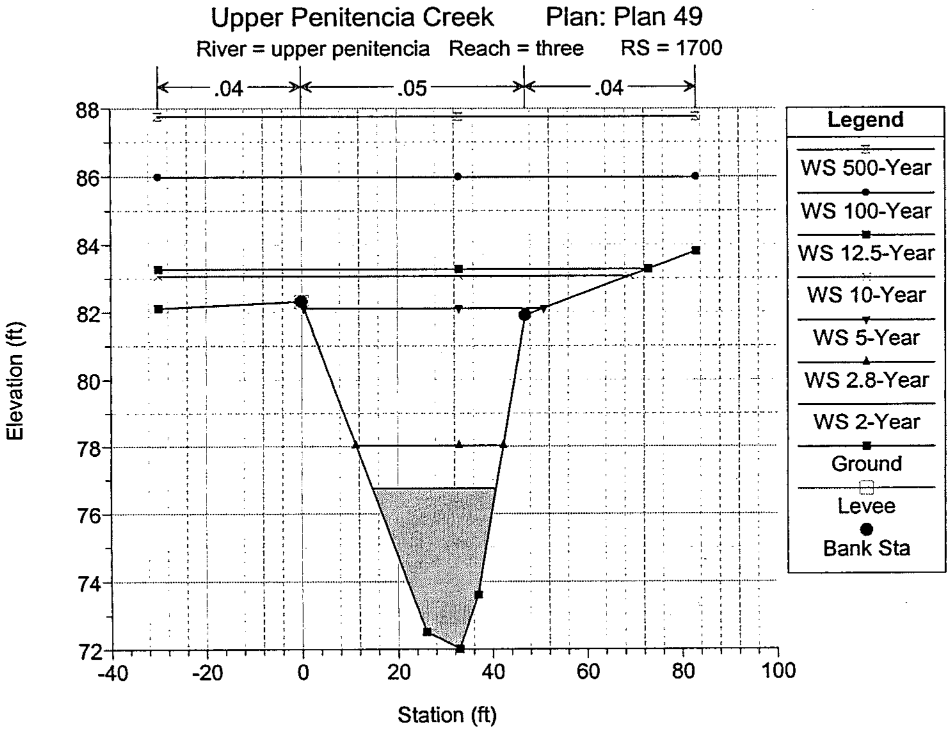


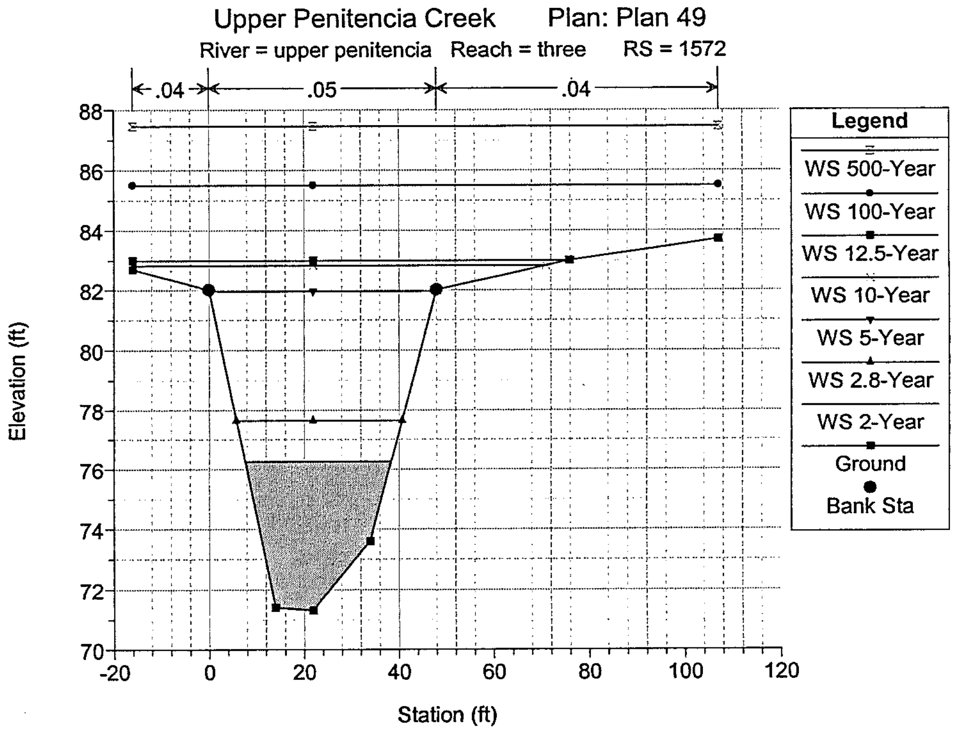
Upper Penitencia Creek Plan: Plan 49
River = upper penitencia Reach = three RS = 1966




Upper Penitencia Creek Plan: Plan 49
River = upper penitencia Reach = three RS = 1879

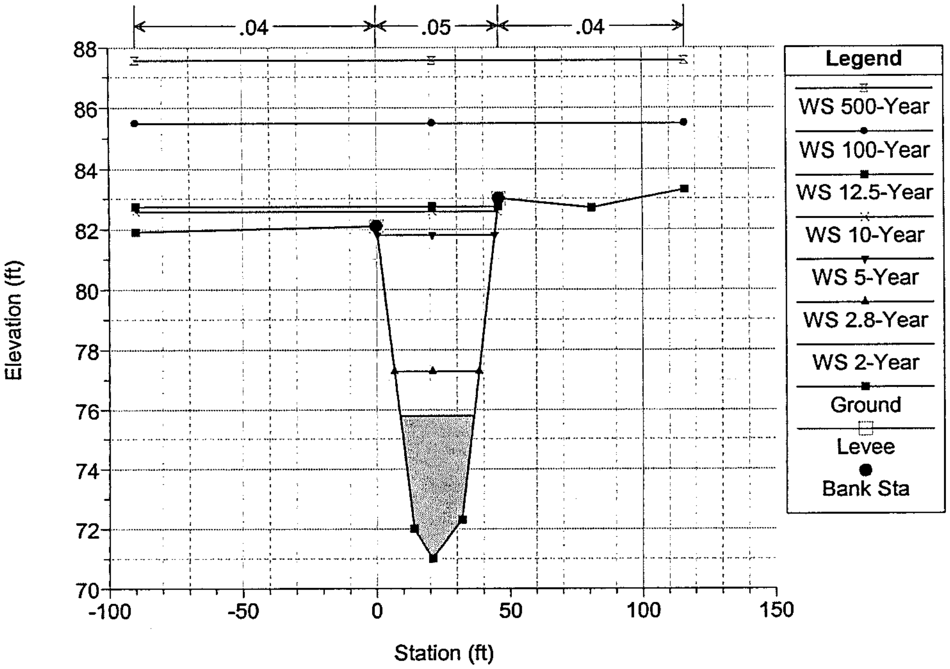

Upper Penitencia Creek Plan: Plan 49
River = upper penitencia Reach = three RS = 1795


Upper Penitencia Creek Plan: Plan 49
River = upper penitencia Reach = three RS = 1700


Upper Penitencia Creek Plan: Plan 49
River = upper penitencia Reach = three RS = 1572

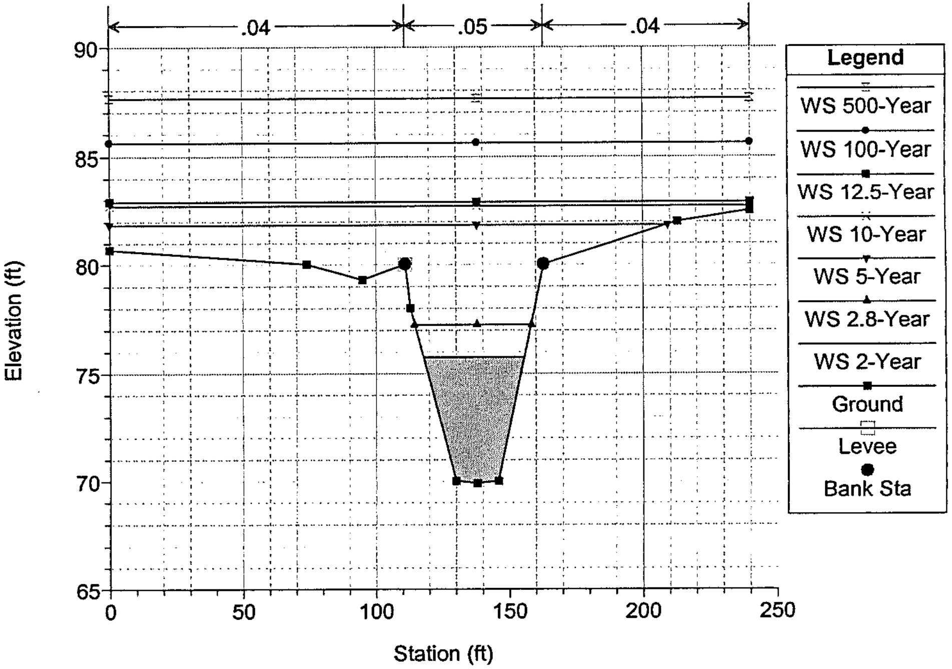
Upper Penitencia Creek Plan: Plan 49

River = upper penitencia Reach = three RS = 1472



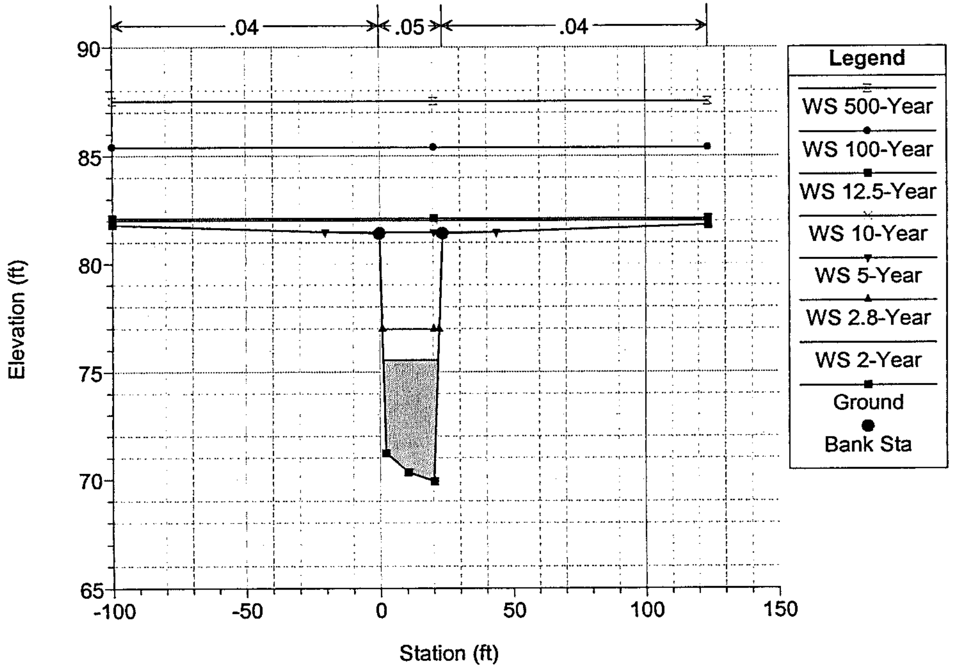
Upper Penitencia Creek Plan: Plan 49

River = upper penitencia Reach = three RS = 1391



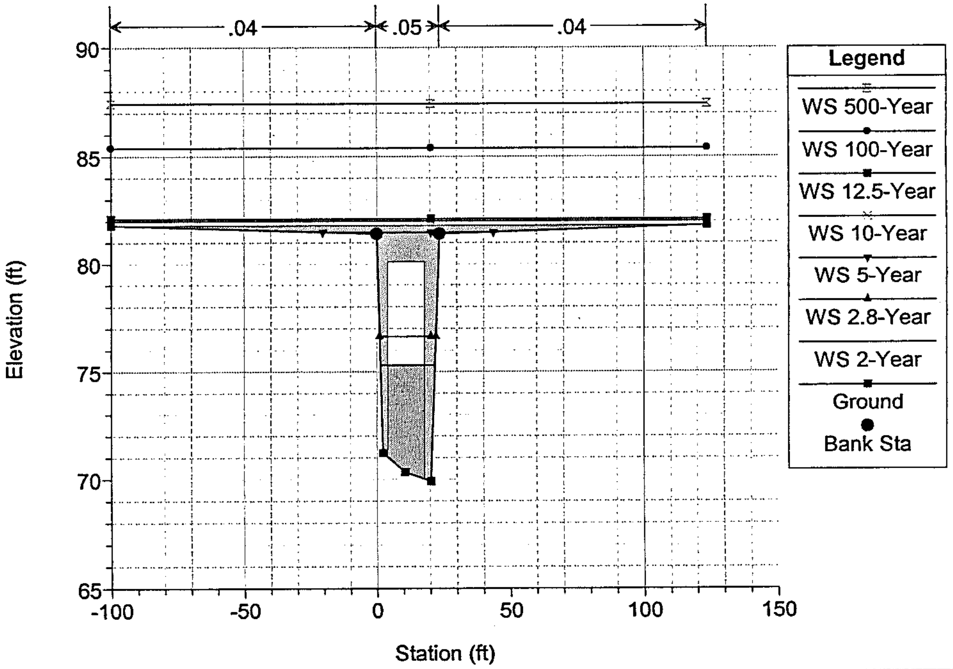
Upper Penitencia Creek Plan: Plan 49

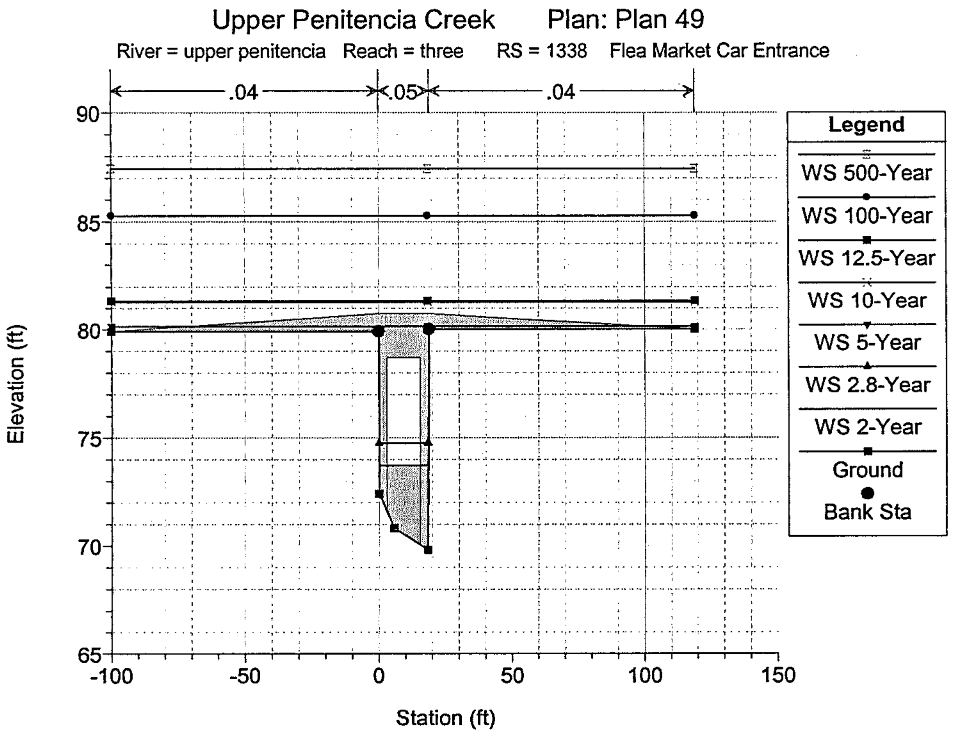
River = upper penitencia Reach = three RS = 1369

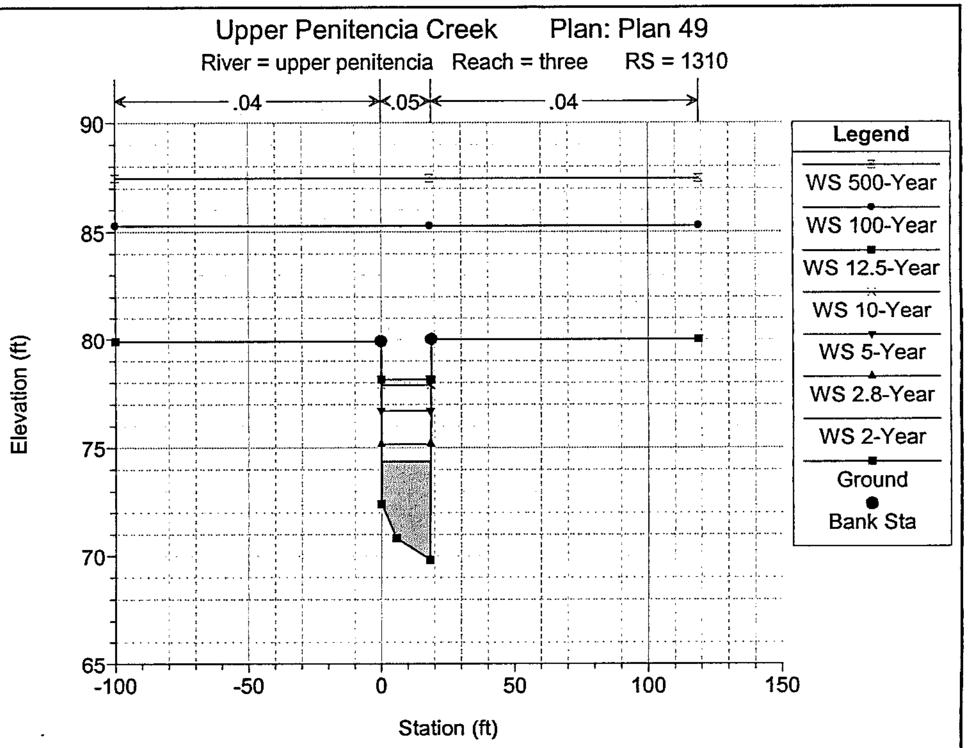


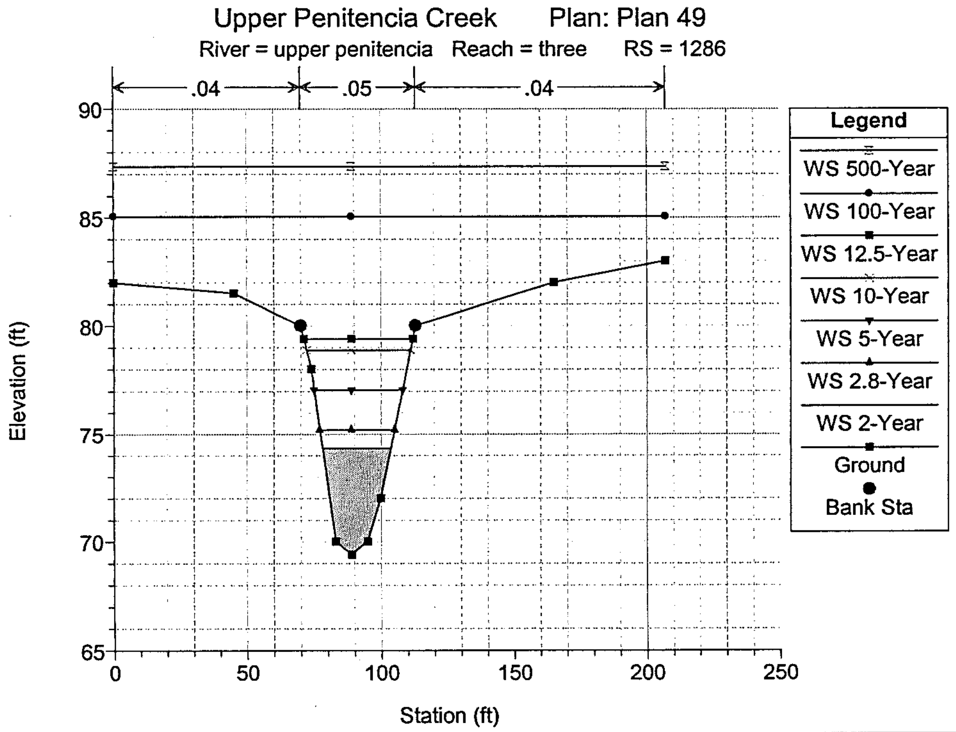
Upper Penitencia Creek Plan: Plan 49

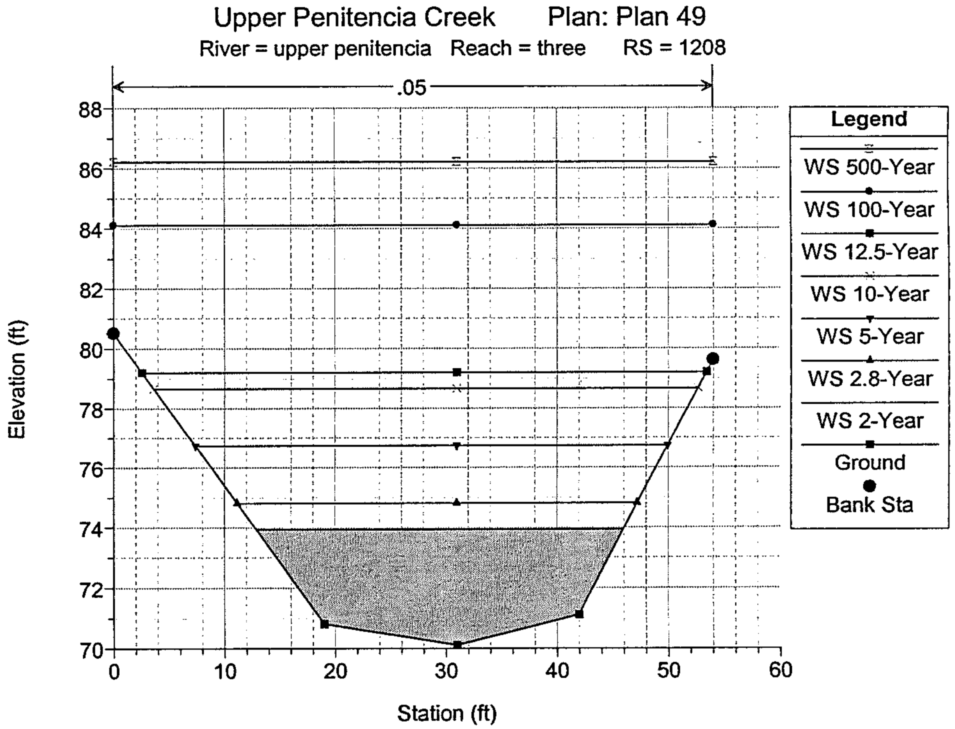
River = upper penitencia Reach = three RS = 1338 Flea Market Car Entrance

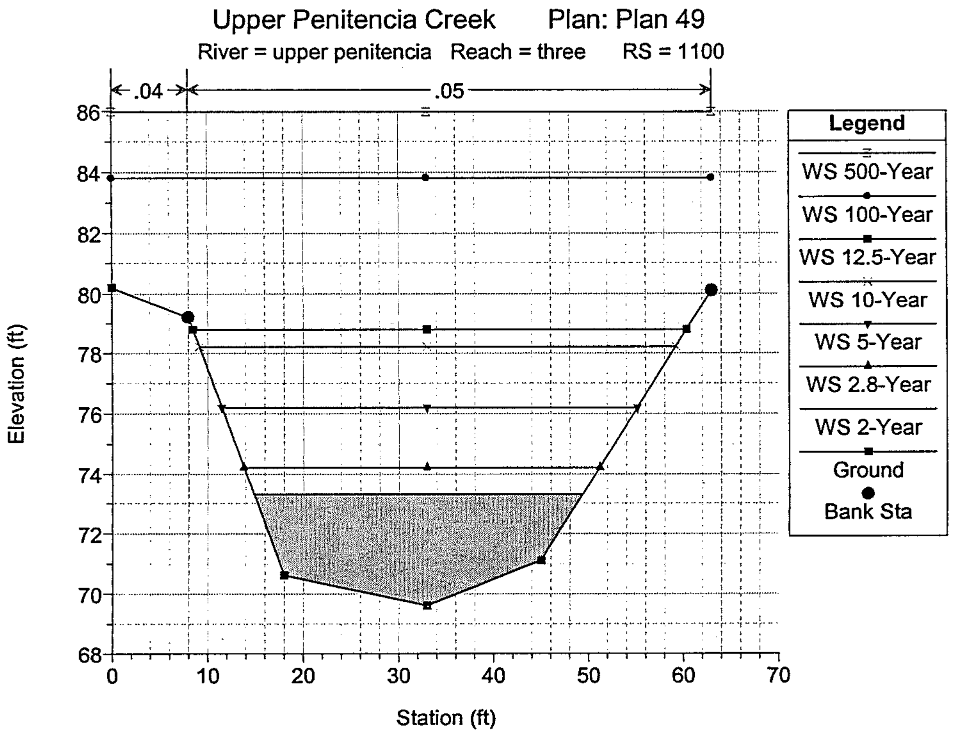



Upper Penitencia Creek Plan: Plan 49
River = upper penitencia Reach = three RS = 1338 Flea Market Car Entrance
.04
.05
.04
Elevation (ft)
90
85
80
75
70
65
-100
-50
0
50
100
150
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 12.5-Year
WS 10-Year
WS 5-Year
WS 2.8-Year
WS 2-Year
Ground
Bank Sta

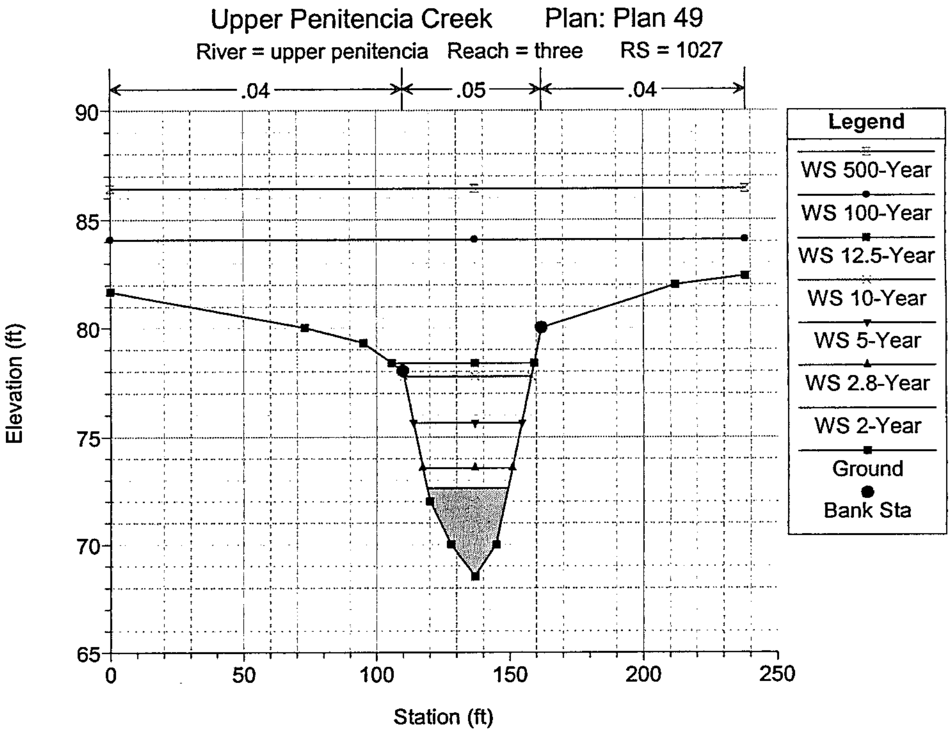

Upper Penitencia Creek Plan: Plan 49
River = upper penitencia Reach = three RS = 1310
.04
.05
.04
Elevation (ft)
90
85
80
75
70
65
-100
-50
0
50
100
150
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 12.5-Year
WS 10-Year
WS 5-Year
WS 2.8-Year
WS 2-Year
Ground
Bank Sta


Upper Penitencia Creek Plan: Plan 49
River = upper penitencia Reach = three RS = 1286
.04
.05
.04
Elevation (ft)
90
85
80
75
70
65
0
50
100
150
200
250
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 12.5-Year
WS 10-Year
WS 5-Year
WS 2.8-Year
WS 2-Year
Ground
Bank Sta

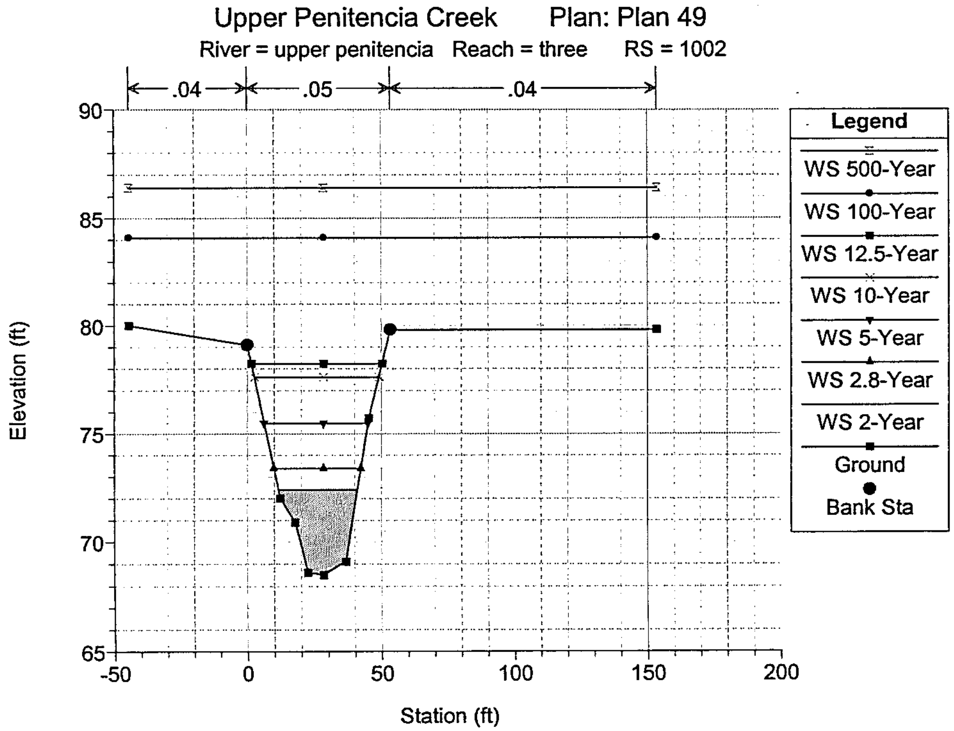

Upper Penitencia Creek Plan: Plan 49
River = upper penitencia Reach = three RS = 1208
.05
Elevation (ft)
88
86
84
82
80
78
76
74
72
70
0
10
20
30
40
50
60
Station (ft)
Legend
WS 500-Year
WS 100-Year
WS 12.5-Year
WS 10-Year
WS 5-Year
WS 2.8-Year
WS 2-Year
Ground
Bank Sta


Upper Penitencia Creek Plan: Plan 49

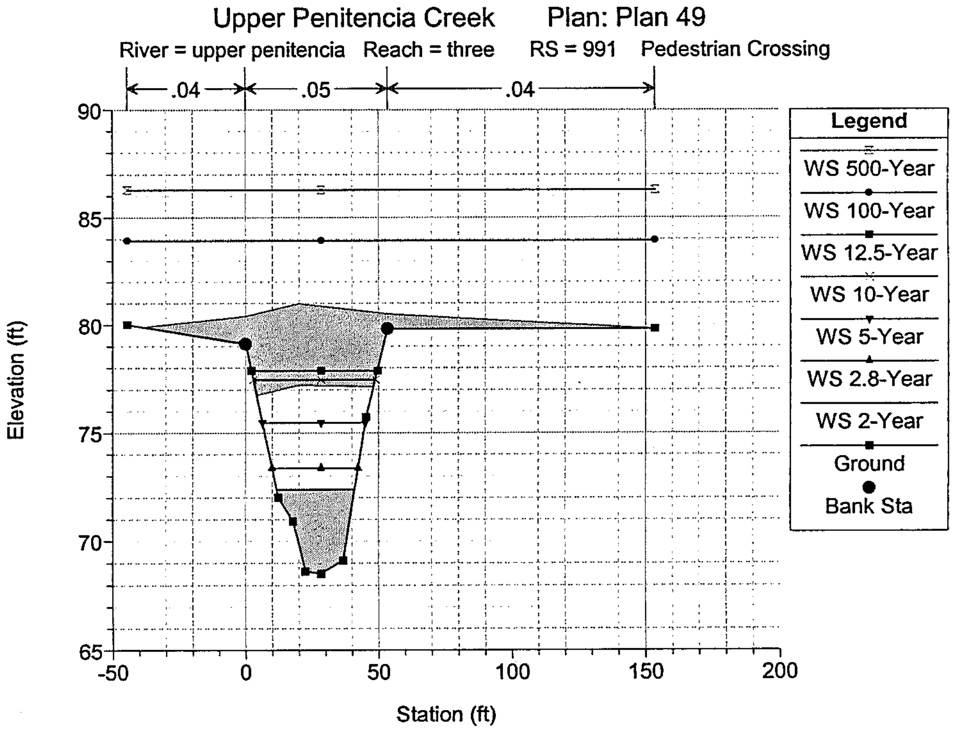
River = upper penitencia Reach = three RS = 1100


Upper Penitencia Creek Plan: Plan 49

River = upper penitencia Reach = three RS = 1027

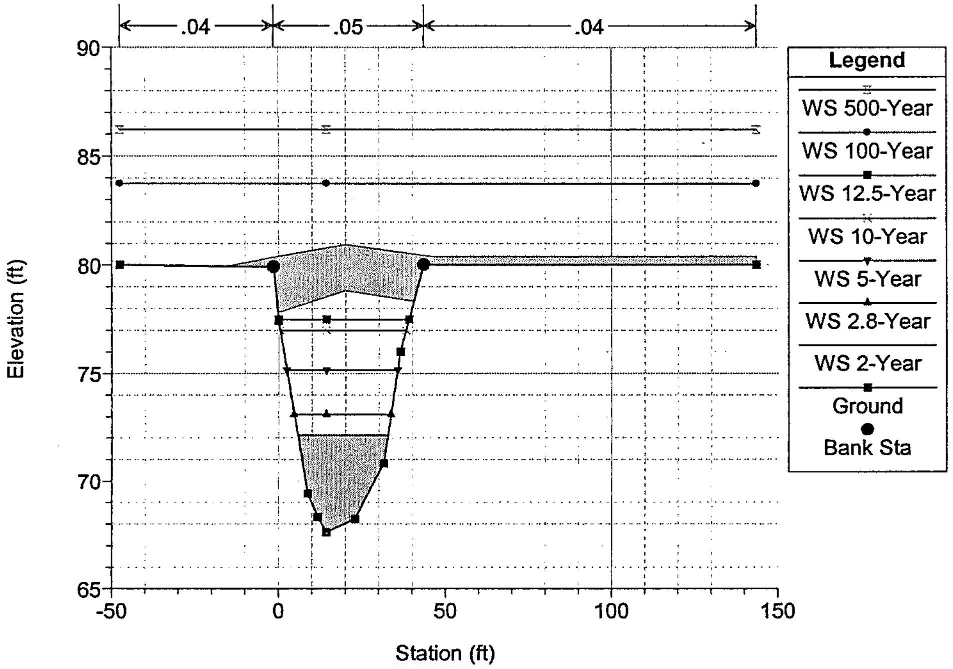

Upper Penitencia Creek Plan: Plan 49

River = upper penitencia Reach = three RS = 1002

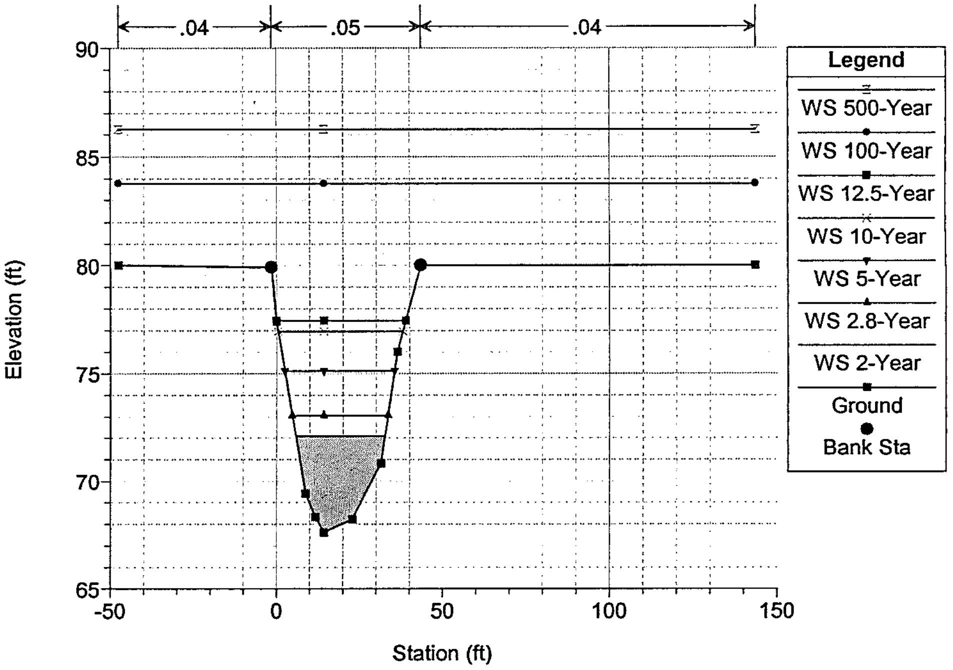

Upper Penitencia Creek Plan: Plan 49

River = upper penitencia Reach = three RS = 991 Pedestrian Crossing

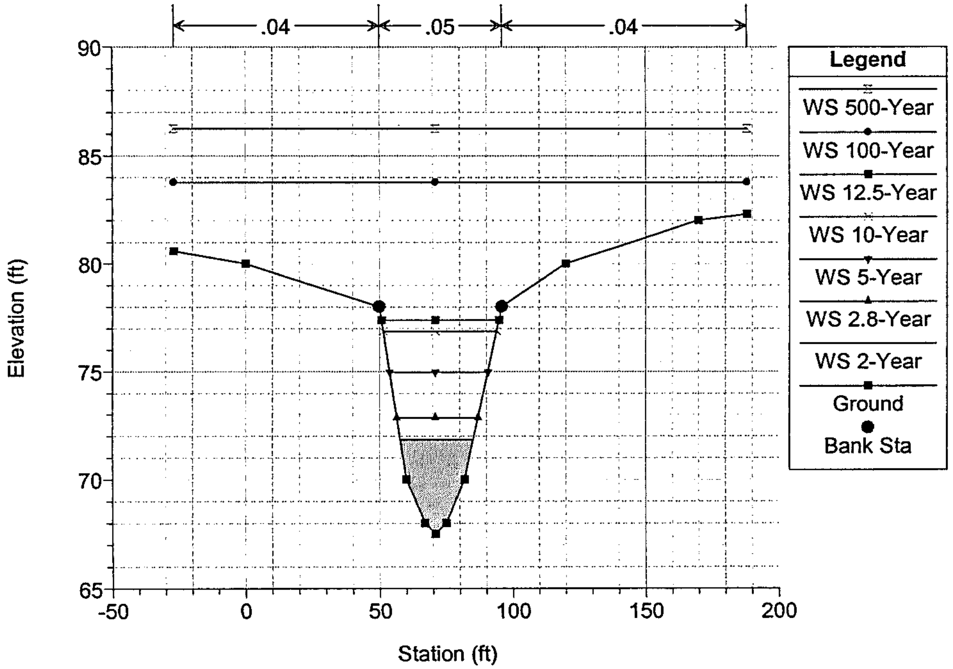
Upper Penitencia Creek Plan: Plan 49
River = upper penitencia Reach = three RS = 991 Pedestrian Crossing



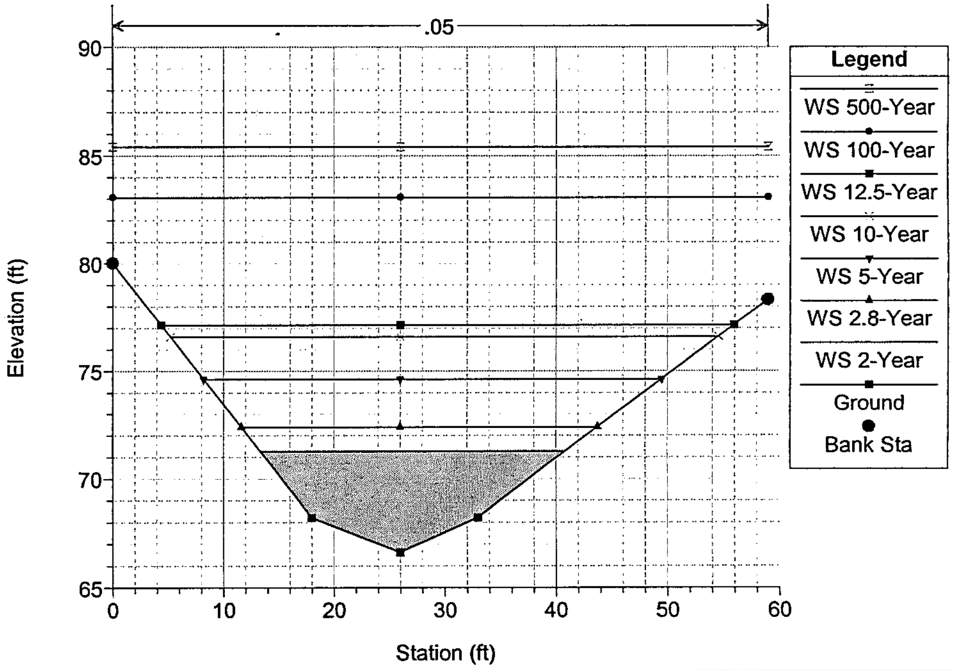
Upper Penitencia Creek Plan: Plan 49
River = upper penitencia Reach = three RS = 958

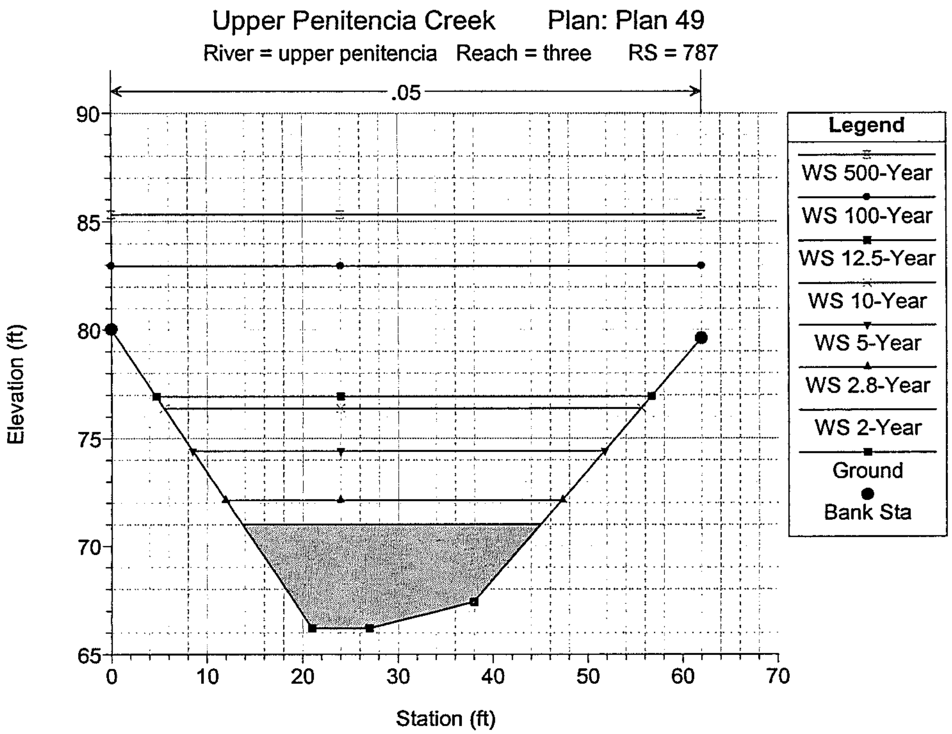


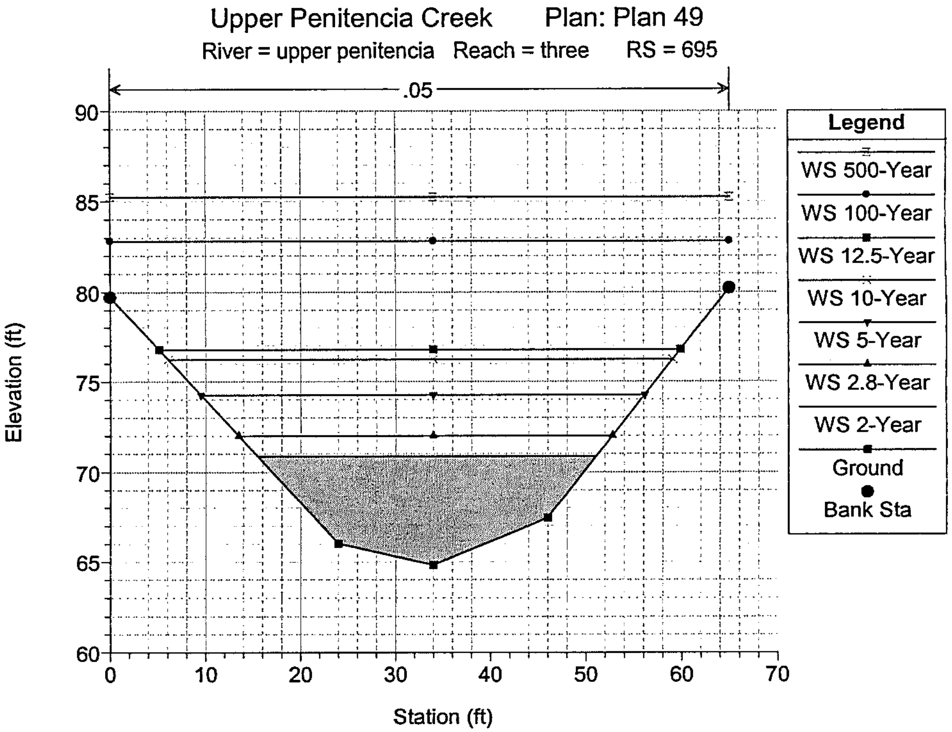
Upper Penitencia Creek Plan: Plan 49
River = upper penitencia Reach = three RS = 933

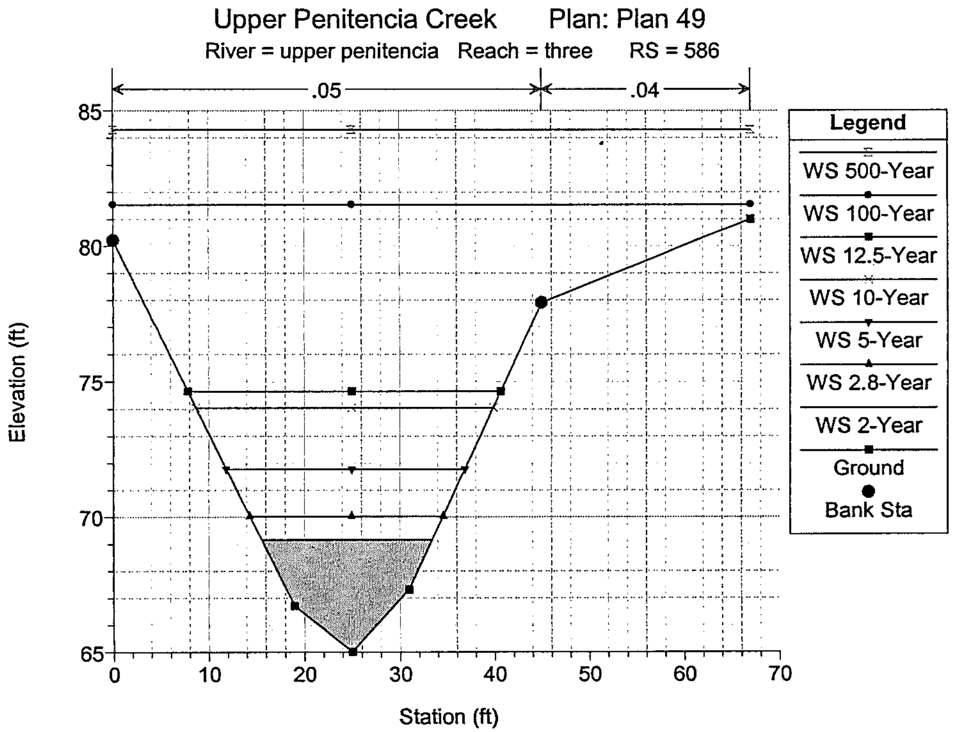


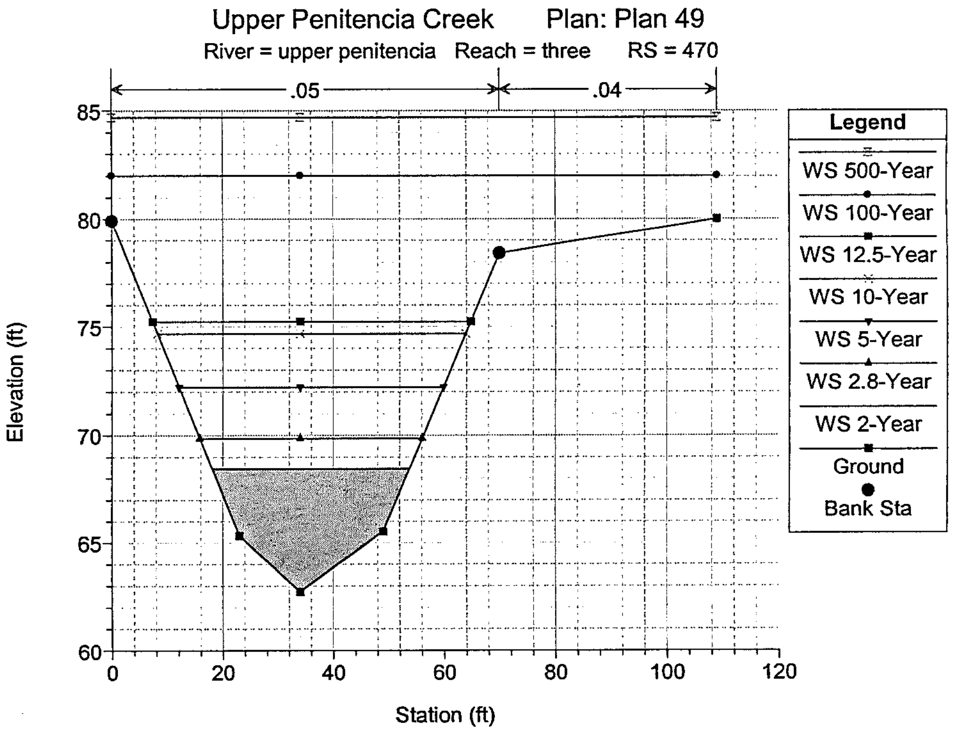
Upper Penitencia Creek Plan: Plan 49
River = upper penitencia Reach = three RS = 865




Upper Penitencia Creek Plan: Plan 49
River = upper penitencia Reach = three RS = 787

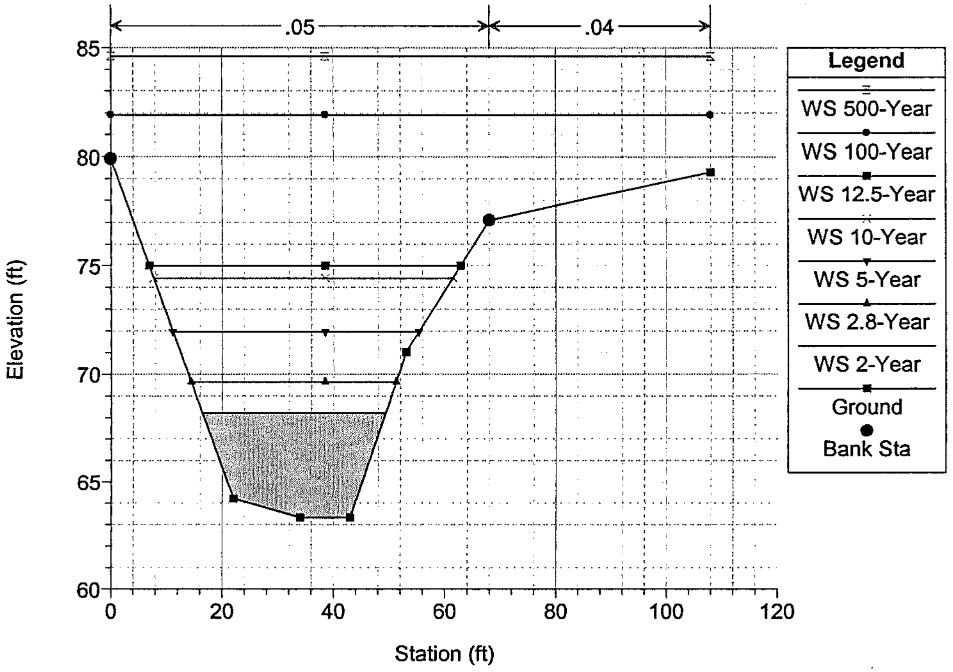

Upper Penitencia Creek Plan: Plan 49
River = upper penitencia Reach = three RS = 695


Upper Penitencia Creek Plan: Plan 49
River = upper penitencia Reach = three RS = 586


Upper Penitencia Creek Plan: Plan 49
River = upper penitencia Reach = three RS = 470

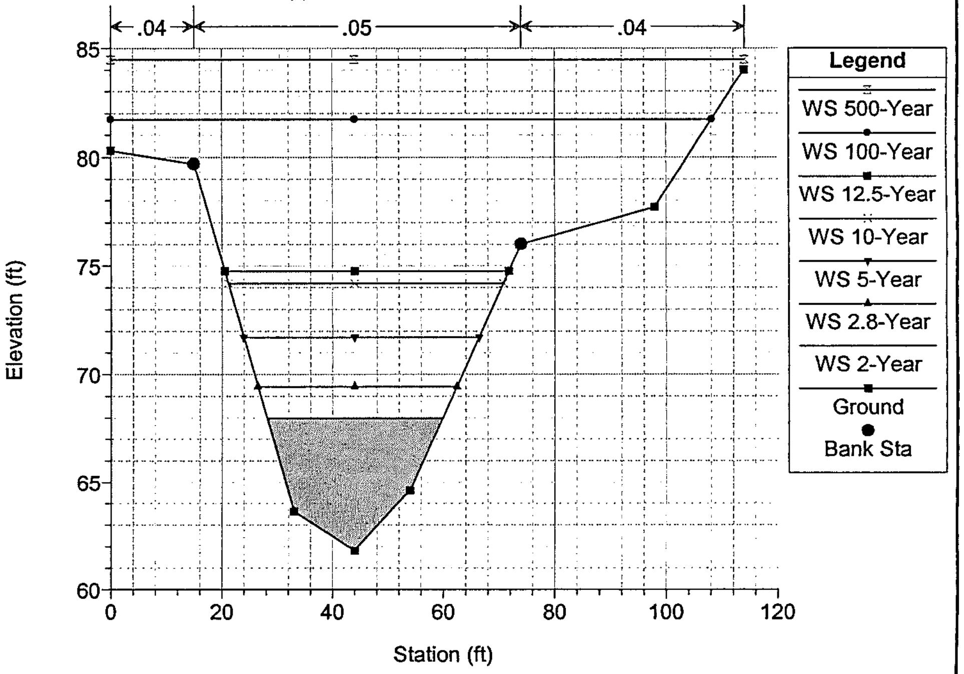
Upper Penitencia Creek Plan: Plan 49

River = upper penitencia Reach = three RS = 362



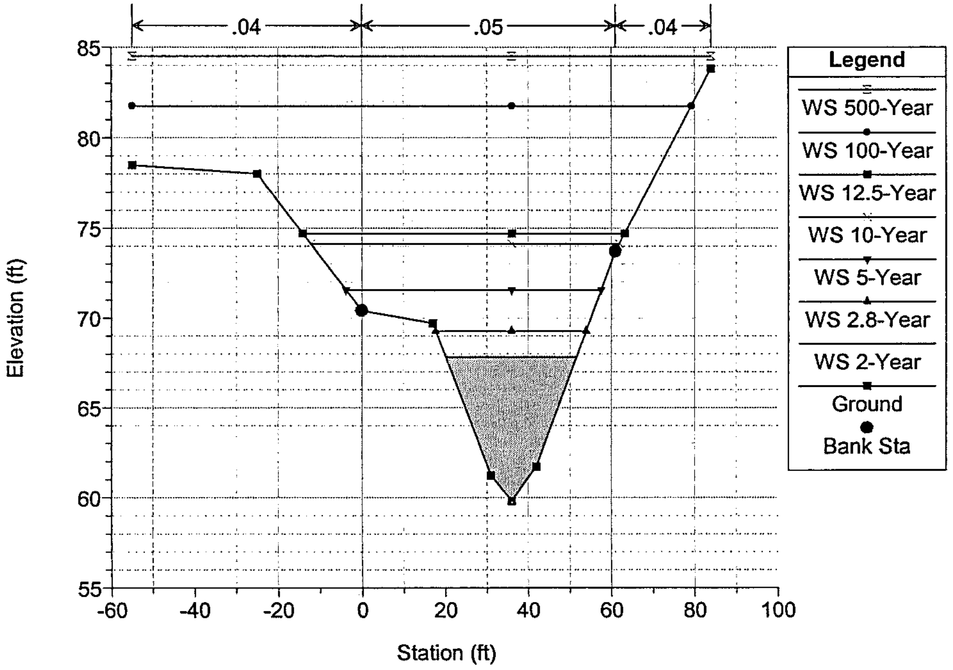
Upper Penitencia Creek Plan: Plan 49

River = upper penitencia Reach = three RS = 252



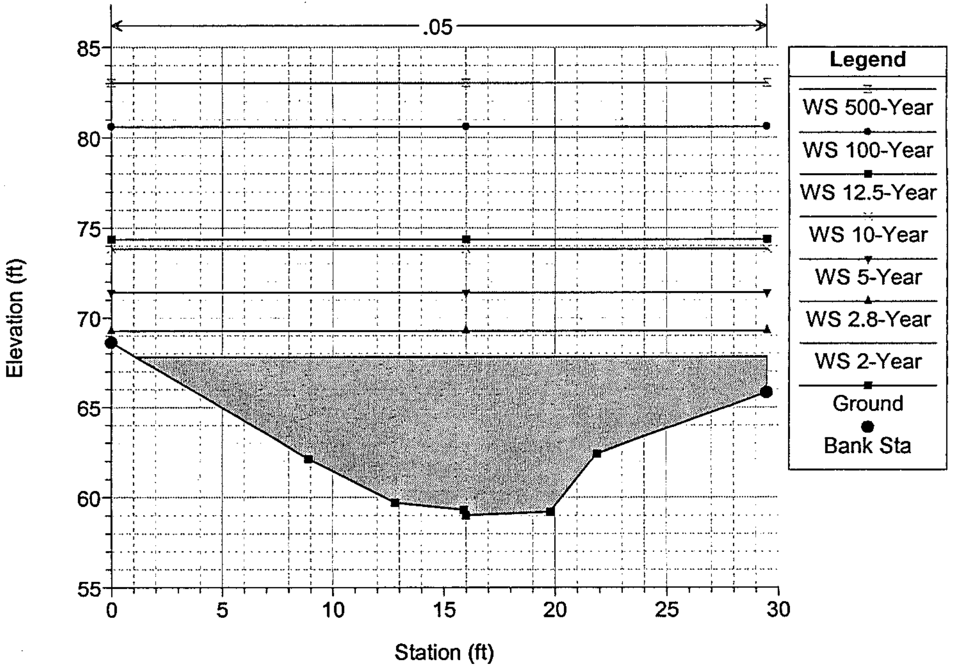
Upper Penitencia Creek Plan: Plan 49

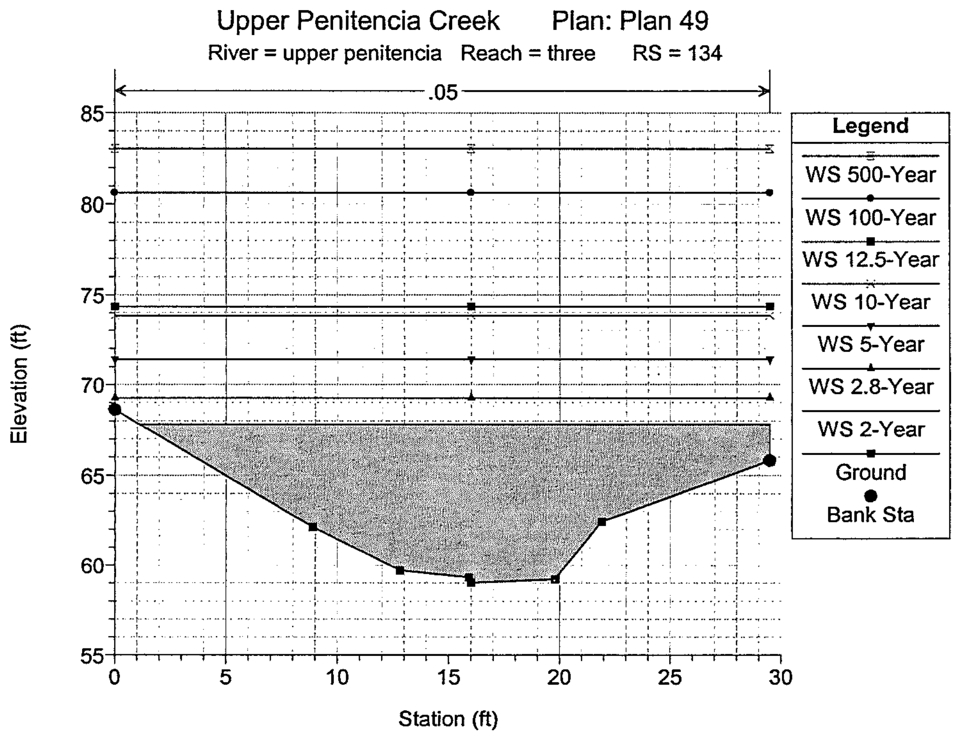
River = upper penitencia Reach = three RS = 145



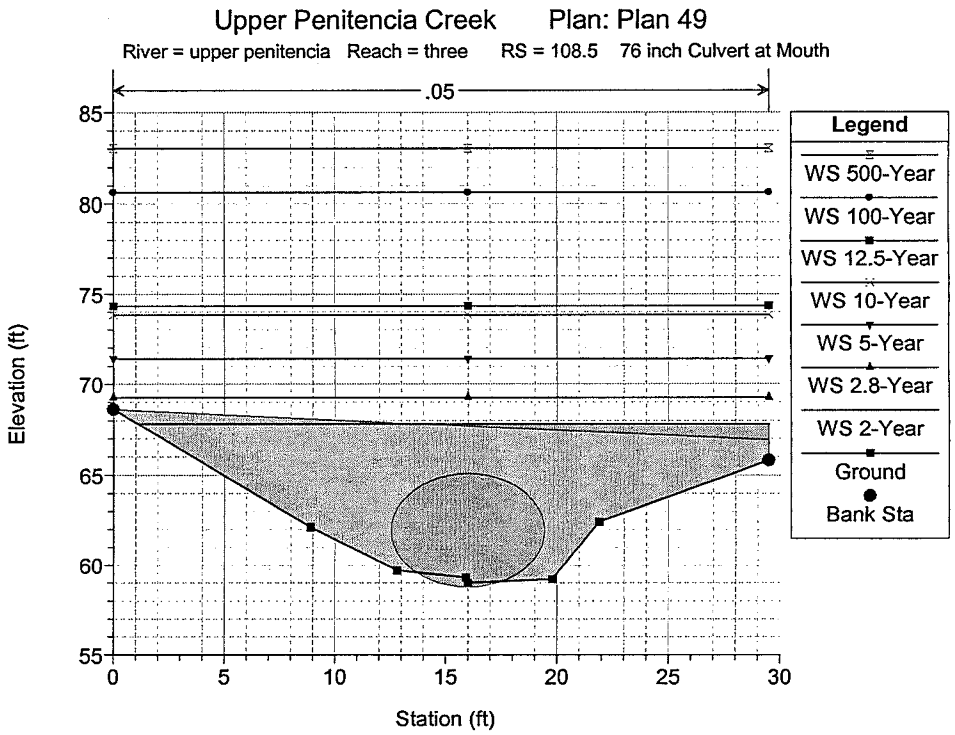
Upper Penitencia Creek Plan: Plan 49

River = upper penitencia Reach = three RS = 135

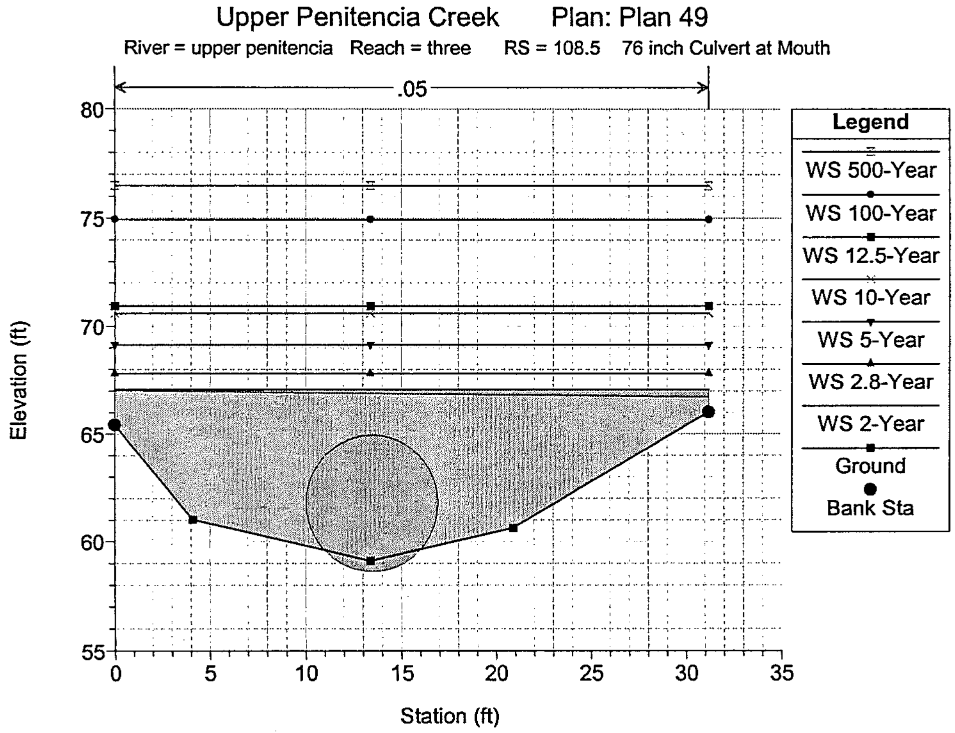



Upper Penitencia Creek Plan: Plan 49

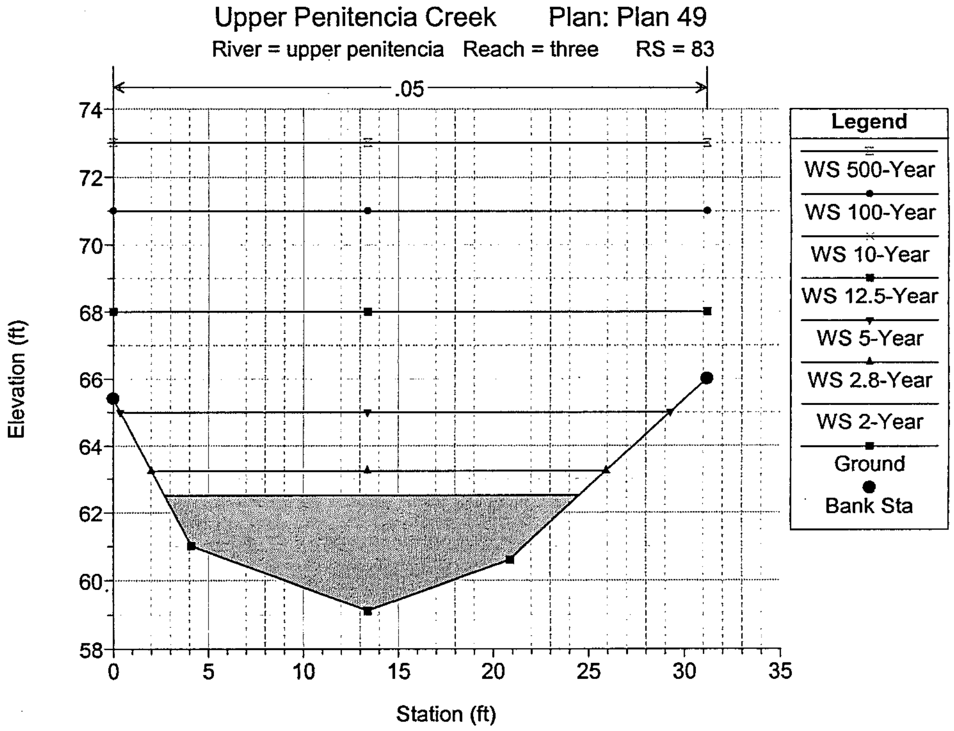
River = upper penitencia Reach = three RS = 134


Upper Penitencia Creek Plan: Plan 49

River = upper penitencia Reach = three RS = 108.5 76 inch Culvert at Mouth


Upper Penitencia Creek Plan: Plan 49

River = upper penitencia Reach = three RS = 108.5 76 inch Culvert at Mouth


Upper Penitencia Creek Plan: Plan 49

River = upper penitencia Reach = three RS = 83

Bypass Channel, Single Box; n = 0.014; s = 0.003; Q = 2.8-yr,
12.5-yr, 100-yr, and 500-yr

HEC-RAS Plan: Plan 68 River: Bypass Channel Reach: One

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
One	2600	180.00	70.70	72.27		72.59	0.001285	4.53	39.71	28.00	0.67
One	2600	1500.00	70.70	76.28		77.79	0.001387	9.86	152.06	28.00	0.75
One	2600	4150.00	70.70	81.70		84.60	0.001471	13.66	303.78	28.00	0.73
One	2600	5360.00	70.70	83.82		87.20	0.001509	14.75	363.28	28.00	0.72
One	2500	180.00	70.60	72.09		72.45	0.001525	4.78	37.66	28.00	0.73
One	2500	1500.00	70.60	76.06		77.64	0.001482	10.09	148.69	28.00	0.77
One	2500	4150.00	70.60	81.48		84.44	0.001518	13.82	300.31	28.00	0.74
One	2500	5360.00	70.60	83.60		87.04	0.001549	14.90	359.72	28.00	0.73
One	2450	180.00	70.50	72.04		72.37	0.001372	4.63	38.91	28.00	0.69
One	2450	1500.00	70.50	76.02		77.56	0.001435	9.98	150.32	28.00	0.76
One	2450	4150.00	70.50	81.43		84.37	0.001497	13.75	301.83	28.00	0.74
One	2450	5360.00	70.50	83.55		86.97	0.001533	14.84	361.09	28.00	0.73
One	2300	180.00	70.30	71.81		72.16	0.001474	4.73	38.05	28.00	0.72
One	2300	1500.00	70.30	75.74		77.33	0.001499	10.13	148.13	28.00	0.78
One	2300	4150.00	70.30	81.14		84.13	0.001531	13.86	299.39	28.00	0.75
One	2300	5360.00	70.30	83.25		86.72	0.001565	14.96	358.33	28.00	0.74
One	2100	180.00	70.00	71.51		71.86	0.001456	4.71	38.20	28.00	0.71
One	2100	1500.00	70.00	75.44		77.03	0.001495	10.12	148.24	28.00	0.78
One	2100	4150.00	70.00	80.82		83.82	0.001539	13.89	298.84	28.00	0.75
One	2100	5360.00	70.00	82.91		86.41	0.001577	15.00	357.35	28.00	0.74
One	1900	180.00	69.70	71.21		71.56	0.001462	4.72	38.15	28.00	0.71
One	1900	1500.00	69.70	75.15		76.74	0.001492	10.11	148.34	28.00	0.77
One	1900	4150.00	69.70	80.50		83.51	0.001546	13.91	298.29	28.00	0.75
One	1900	5360.00	69.70	82.58		86.09	0.001589	15.04	356.36	28.00	0.74
One	1700	180.00	69.40	70.90		71.25	0.001519	4.77	37.70	28.00	0.73
One	1700	1500.00	69.40	74.85		76.44	0.001489	10.10	148.44	28.00	0.77
One	1700	4150.00	69.40	80.18		83.20	0.001554	13.94	297.75	28.00	0.75
One	1700	5360.00	69.40	82.24		85.77	0.001601	15.08	355.37	28.00	0.75
One	1500	180.00	69.10	70.58		70.94	0.001578	4.83	37.25	28.00	0.74
One	1500	1500.00	69.10	74.56		76.14	0.001486	10.10	148.54	28.00	0.77
One	1500	4150.00	69.10	79.86		82.89	0.001562	13.96	297.20	28.00	0.76
One	1500	5360.00	69.10	81.91		85.46	0.001613	15.12	354.39	28.00	0.75
One	1325	180.00	68.80	70.35		70.68	0.001346	4.60	39.14	28.00	0.69
One	1325	1500.00	68.80	74.33		75.87	0.001425	9.96	150.67	28.00	0.76
One	1325	4150.00	68.80	79.61		82.61	0.001543	13.90	298.50	28.00	0.75
One	1325	5360.00	68.80	81.64		85.17	0.001603	15.09	355.23	28.00	0.75
One	1250	180.00	68.70	70.24		70.57	0.001385	4.64	38.80	28.00	0.69
One	1250	1500.00	68.70	74.20		75.76	0.001449	10.01	149.84	28.00	0.76
One	1250	4150.00	68.70	79.46		82.49	0.001563	13.97	297.17	28.00	0.76
One	1250	5360.00	68.70	81.48		85.05	0.001623	15.16	353.59	28.00	0.75
One	1100	180.00	68.50	69.99		70.35	0.001526	4.78	37.65	28.00	0.73
One	1100	1500.00	68.50	73.91		75.52	0.001528	10.19	147.17	28.00	0.78
One	1100	4150.00	68.50	79.16		82.25	0.001606	14.10	294.22	28.00	0.77
One	1100	5360.00	68.50	81.15		84.79	0.001668	15.31	350.00	28.00	0.76
One	900	180.00	68.20	69.70		70.05	0.001497	4.75	37.87	28.00	0.72
One	900	1500.00	68.20	73.59		75.21	0.001544	10.23	146.65	28.00	0.79
One	900	4150.00	68.20	78.76		81.91	0.001648	14.24	291.47	28.00	0.78
One	900	5360.00	68.20	80.71		84.43	0.001719	15.49	346.08	28.00	0.78
One	700	180.00	67.90	69.43		69.77	0.001412	4.67	38.56	28.00	0.70
One	700	1500.00	67.90	73.27		74.91	0.001560	10.26	146.13	28.00	0.79
One	700	4150.00	67.90	78.33		81.56	0.001708	14.42	287.72	28.00	0.79
One	700	5360.00	67.90	80.23		84.07	0.001790	15.72	341.00	28.00	0.79
One	500	180.00	67.60	69.17	68.84	69.49	0.001290	4.54	39.67	28.00	0.67
One	500	1500.00	67.60	72.95	72.22	74.60	0.001577	10.30	145.61	28.00	0.80
One	500	4150.00	67.60	77.84	76.53	81.19	0.001795	14.68	282.62	28.00	0.81
One	500	5360.00	67.60	79.67	78.18	83.68	0.001896	16.06	333.84	28.00	0.82
One	300	180.00	67.30	68.54	68.54	69.08	0.003041	5.92	30.40	28.00	1.00
One	300	1500.00	67.30	71.92	71.92	74.15	0.002485	11.99	125.06	28.00	1.00

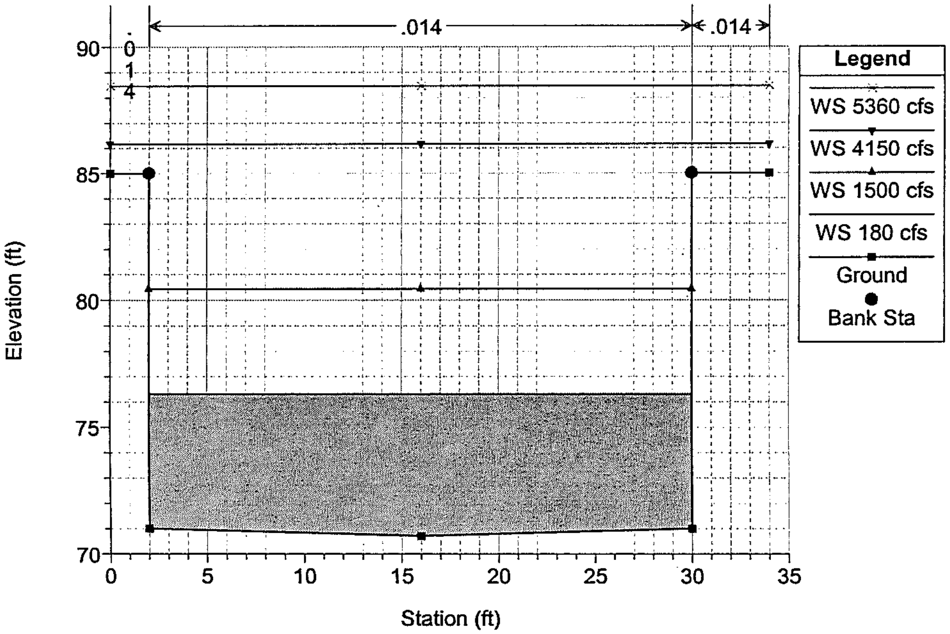
HEC-RAS Plan: Plan 68 River: Bypass Channel Reach: One (Continued)

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
One	300	4150.00	67.30	76.22	76.22	80.65	0.002654	16.89	245.70	28.00	1.00
One	300	5360.00	67.30	77.88	77.88	83.11	0.002733	18.35	292.09	28.00	1.00

Bypass Channel Alignment Plan: 1) Plan 68

Geom: Single Box 28'x14' s=0.0015 n=0.014

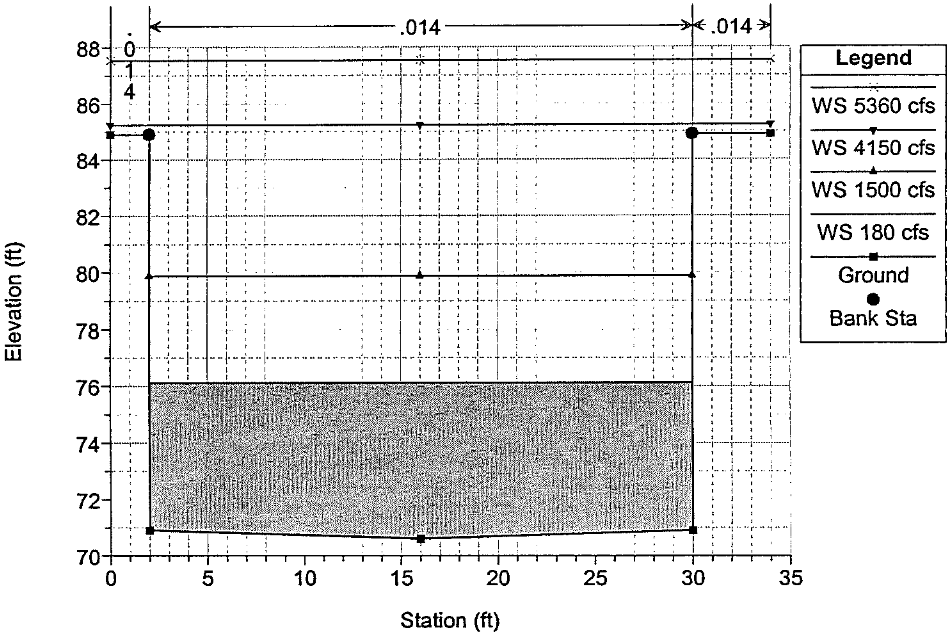
River = Bypass Channel Reach = One RS = 2600



Bypass Channel Alignment Plan: 1) Plan 68

Geom: Single Box 28'x14' s=0.0015 n=0.014

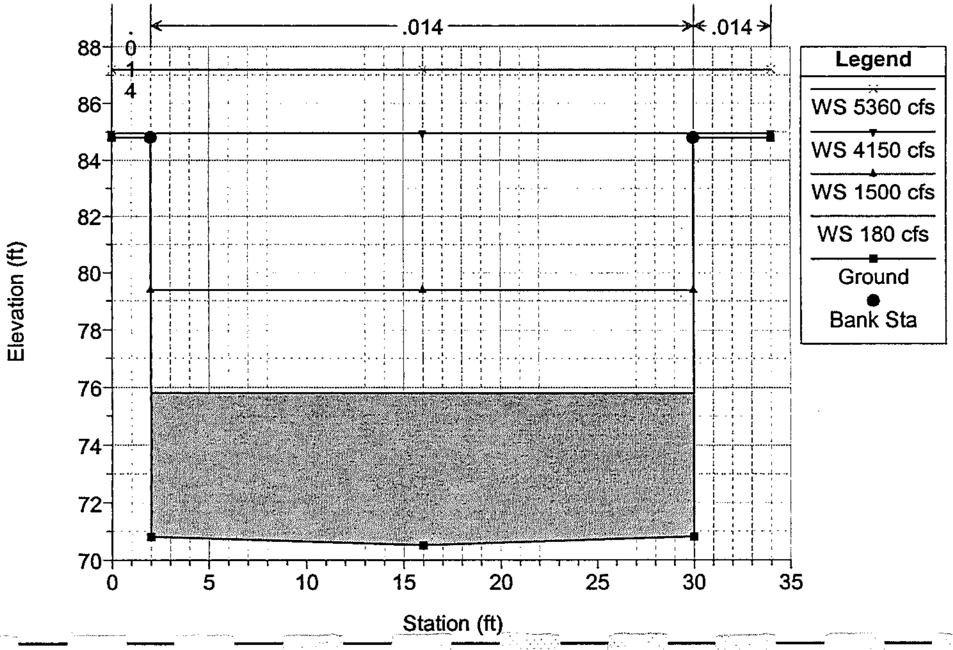
River = Bypass Channel Reach = One RS = 2500



Bypass Channel Alignment Plan: 1) Plan 68

Geom: Single Box 28'x14' s=0.0015 n=0.014

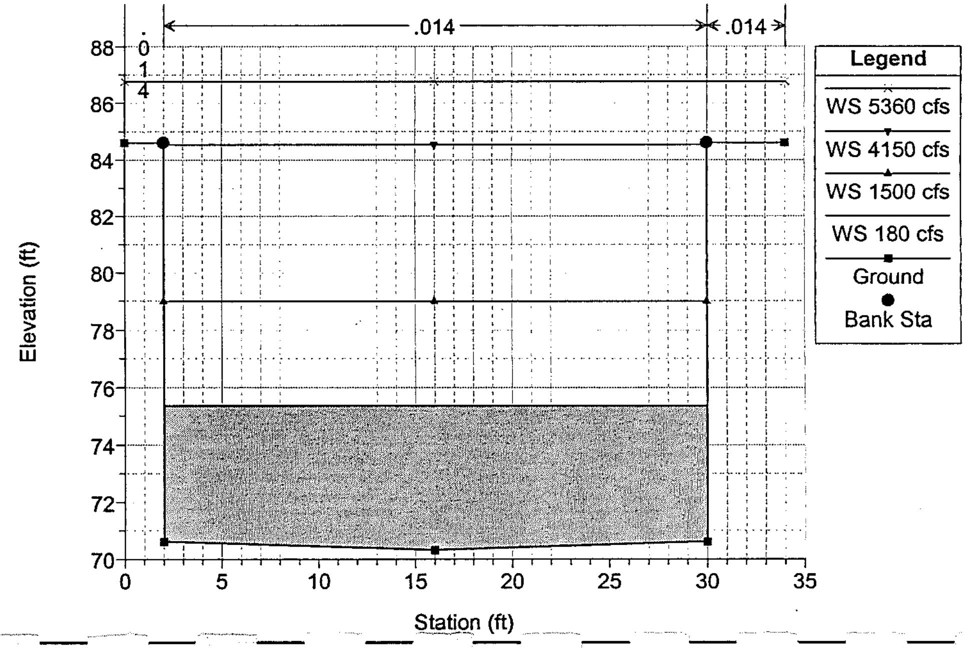
River = Bypass Channel Reach = One RS = 2450 Start of Double Box, End of U-channel



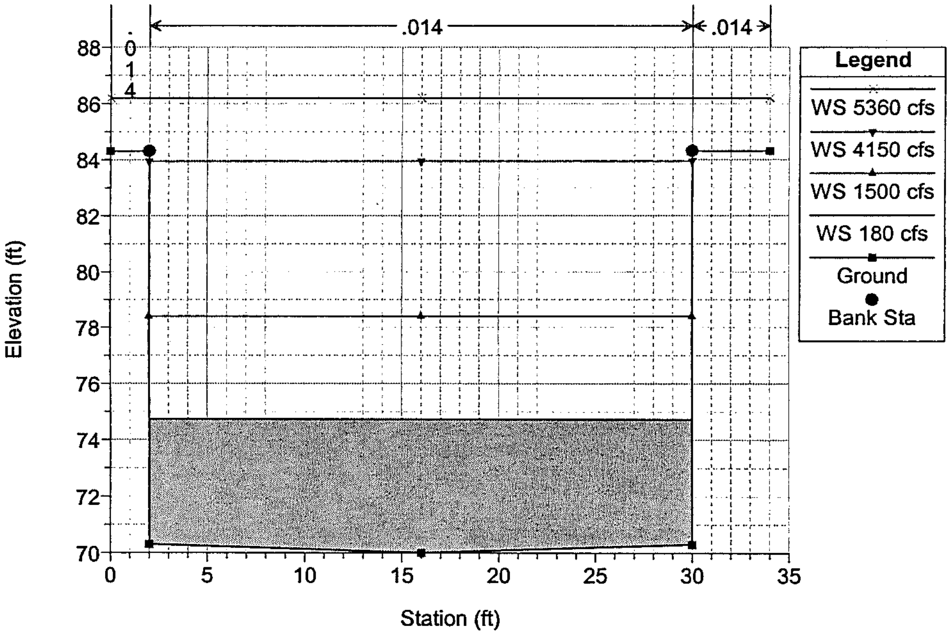
Bypass Channel Alignment Plan: 1) Plan 68

Geom: Single Box 28'x14' s=0.0015 n=0.014

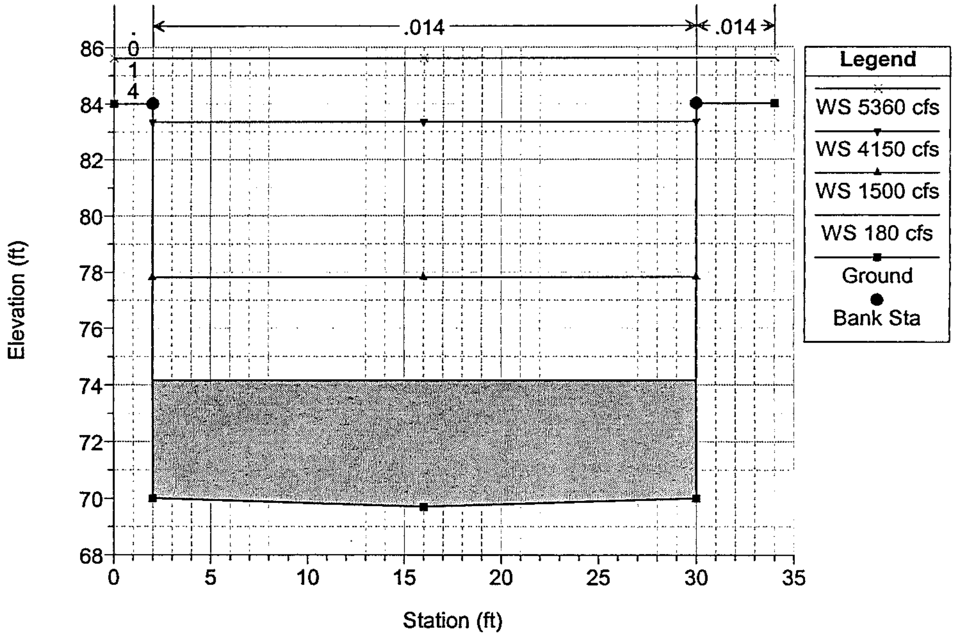
River = Bypass Channel Reach = One RS = 2300



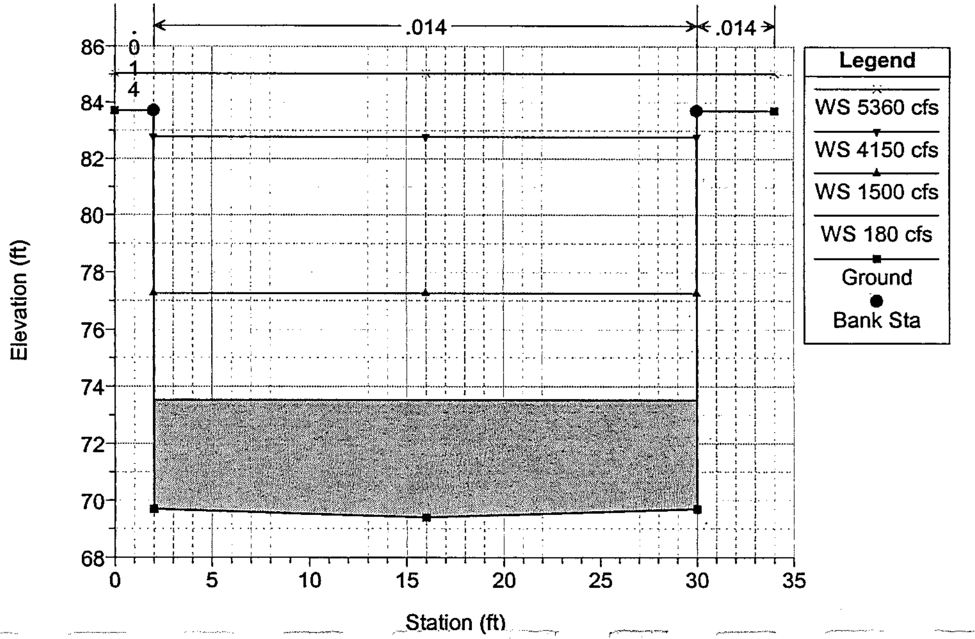
Bypass Channel Alignment Plan: 1) Plan 68
Geom: Single Box 28'x14' s=0.0015 n=0.014
River = Bypass Channel Reach = One RS = 2100



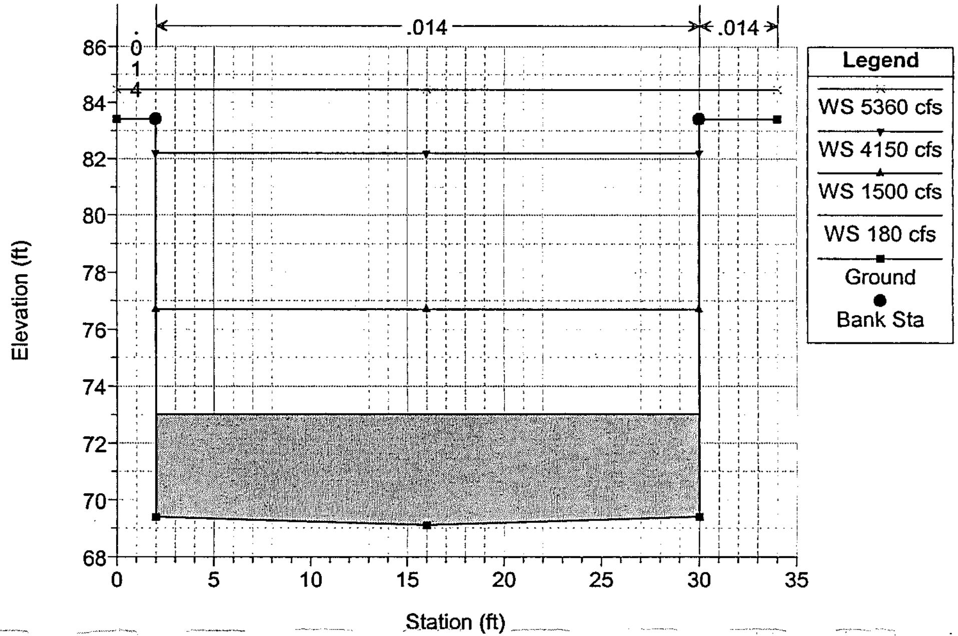
Bypass Channel Alignment Plan: 1) Plan 68
Geom: Single Box 28'x14' s=0.0015 n=0.014
River = Bypass Channel Reach = One RS = 1900

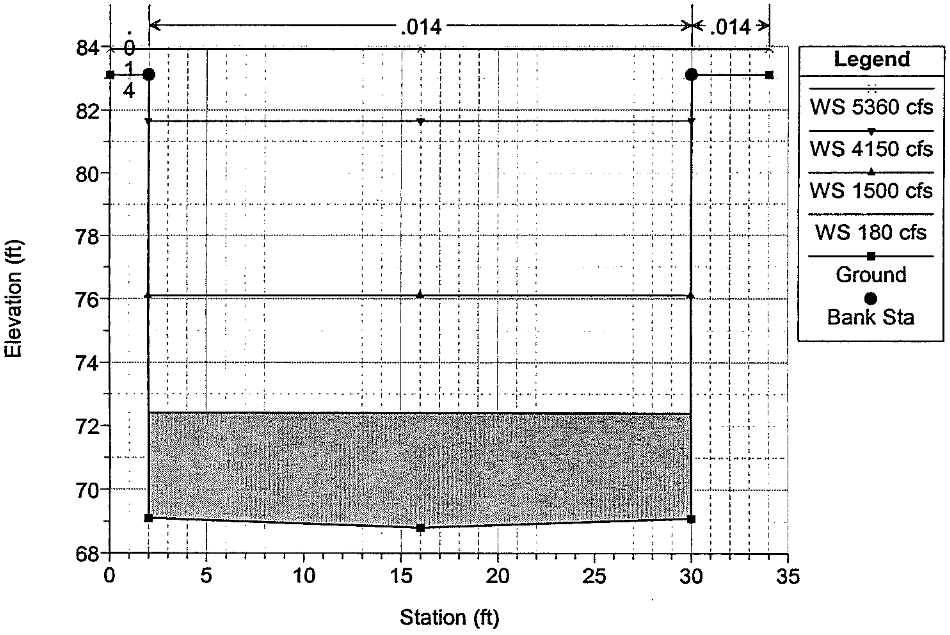


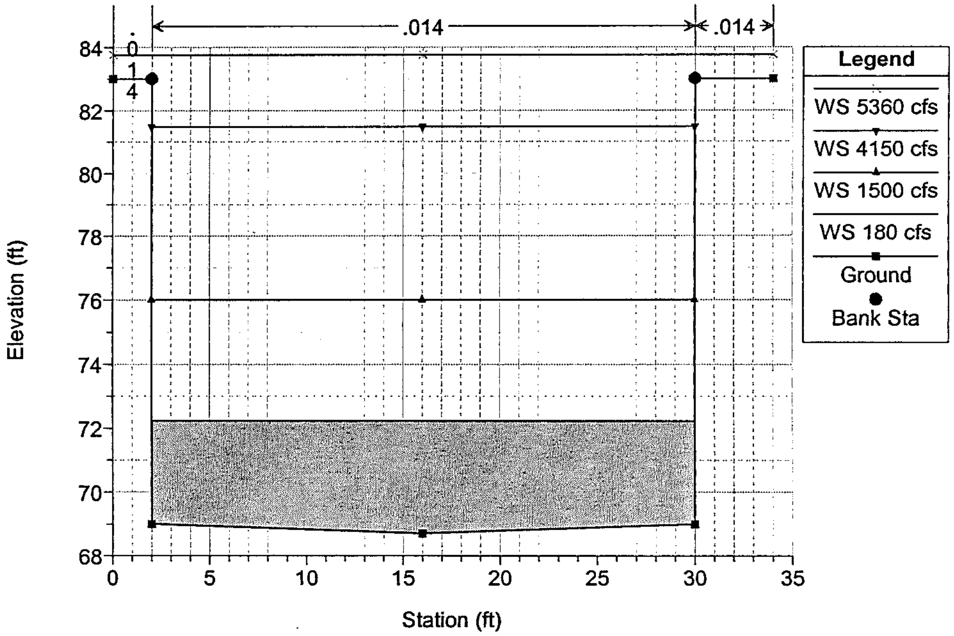
Bypass Channel Alignment Plan: 1) Plan 68
Geom: Single Box 28'x14' s=0.0015 n=0.014
River = Bypass Channel Reach = One RS = 1700

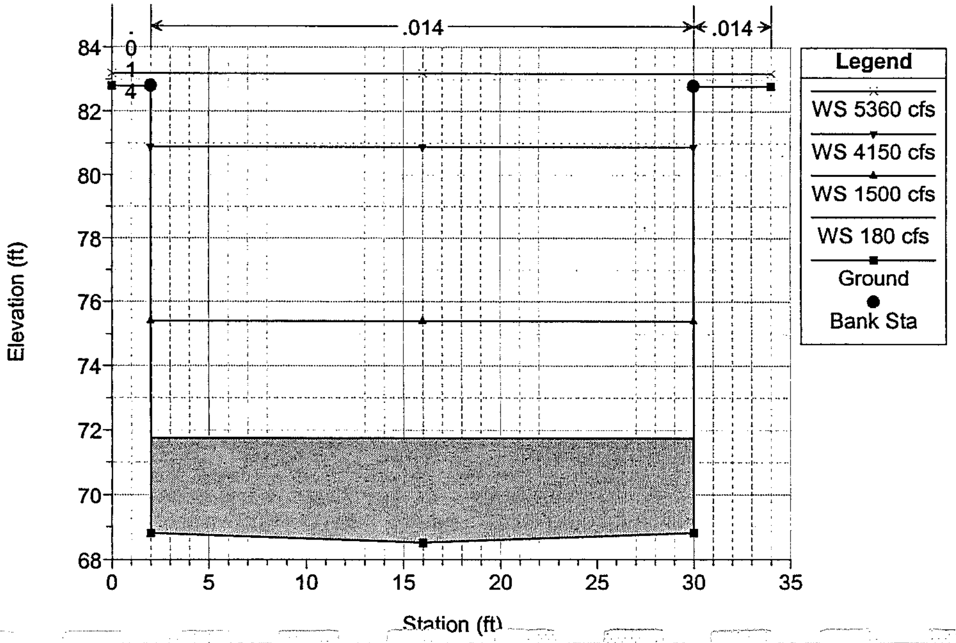


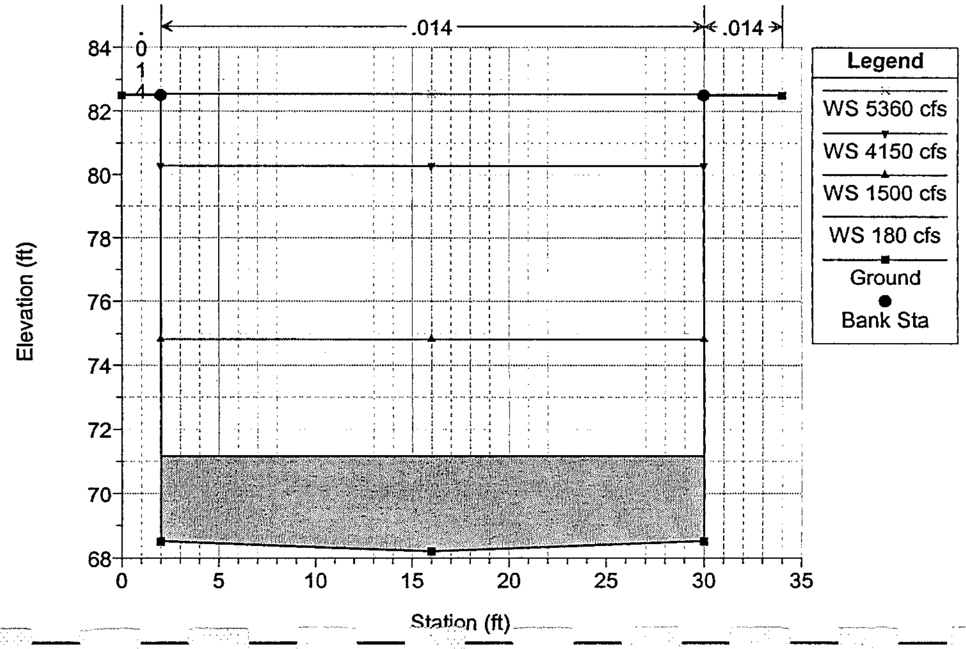
Bypass Channel Alignment Plan: 1) Plan 68
Geom: Single Box 28'x14' s=0.0015 n=0.014
River = Bypass Channel Reach = One RS = 1500



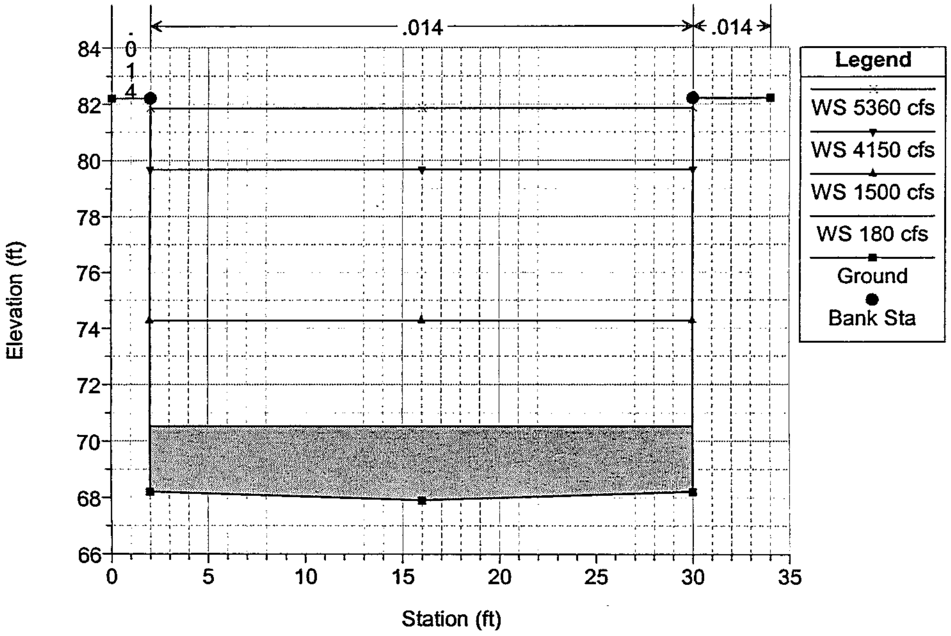

Bypass Channel Alignment Plan: 1) Plan 68
Geom: Single Box 28'x14' s=0.0015 n=0.014
River = Bypass Channel Reach = One RS = 1325


Bypass Channel Alignment Plan: 1) Plan 68
Geom: Single Box 28'x14' s=0.0015 n=0.014
River = Bypass Channel Reach = One RS = 1250

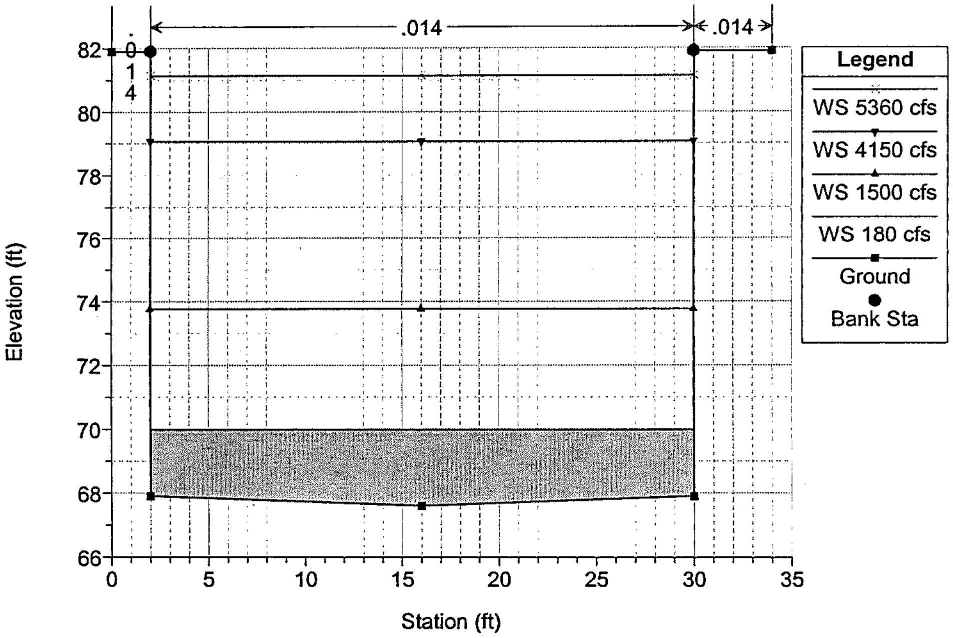

Bypass Channel Alignment Plan: 1) Plan 68
Geom: Single Box 28'x14' s=0.0015 n=0.014
River = Bypass Channel Reach = One RS = 1100


Bypass Channel Alignment Plan: 1) Plan 68
Geom: Single Box 28'x14' s=0.0015 n=0.014
River = Bypass Channel Reach = One RS = 900

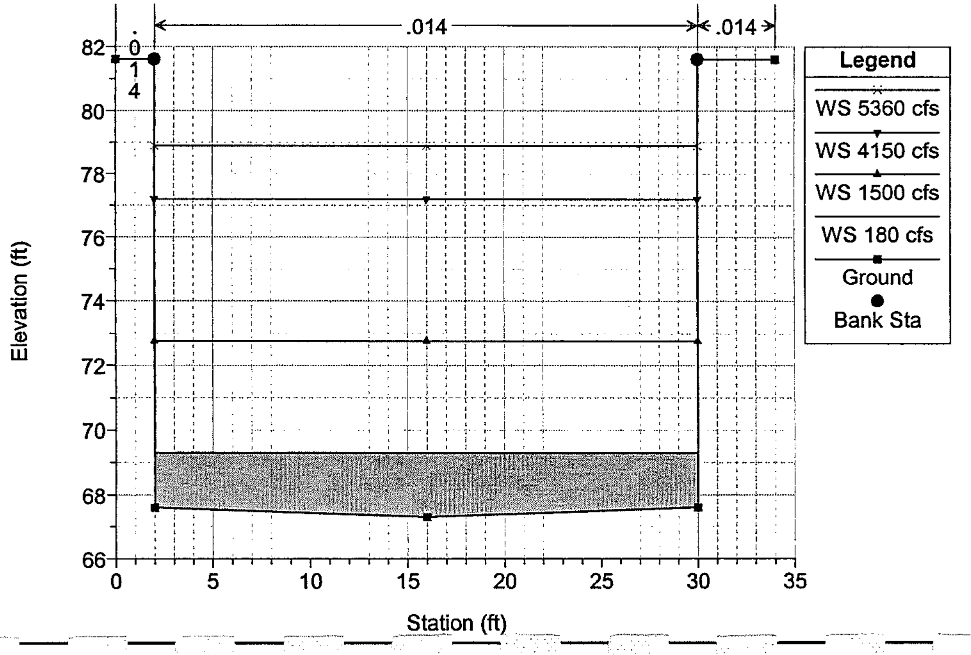
Bypass Channel Alignment Plan: 1) Plan 68
Geom: Single Box 28'x14' s=0.0015 n=0.014
River = Bypass Channel Reach = One RS = 700



Bypass Channel Alignment Plan: 1) Plan 68
Geom: Single Box 28'x14' s=0.0015 n=0.014
River = Bypass Channel Reach = One RS = 500



Bypass Channel Alignment Plan: 1) Plan 68
Geom: Single Box 28'x14' s=0.0015 n=0.014
River = Bypass Channel Reach = One RS = 300 Mouth of channel to Coyote Creek



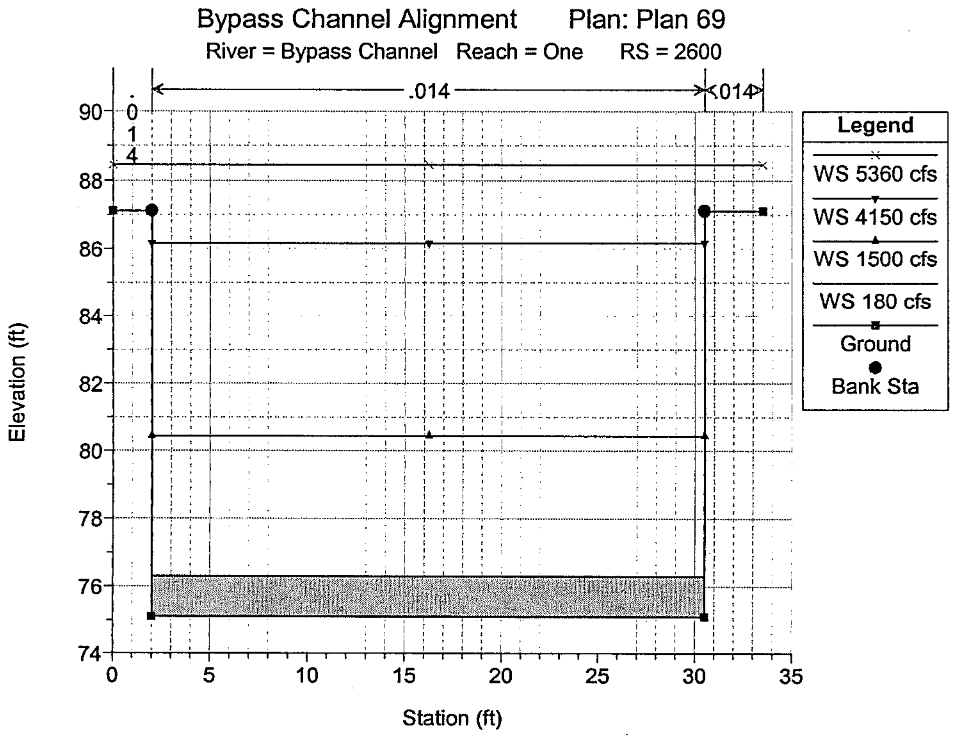
Bypass Channel; Double Box; n = 0.014; s = 0.0015; Q = 2.8-yr,
12.5-yr, 100-yr, and 500-yr

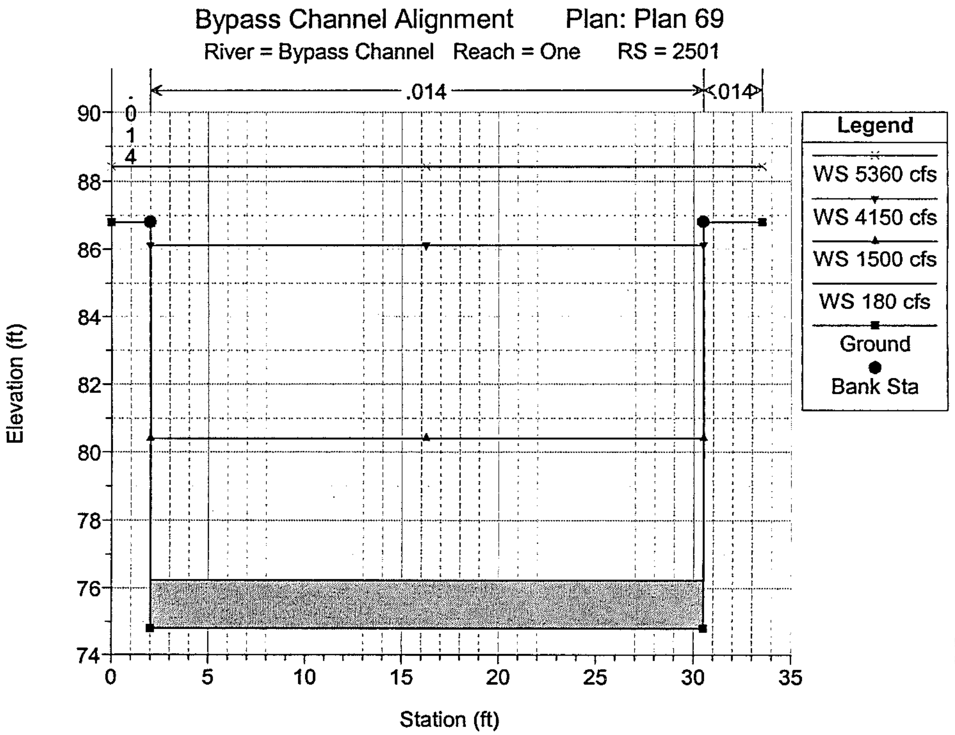
HEC-RAS Plan: Plan 68 River: Bypass Channel Reach: One

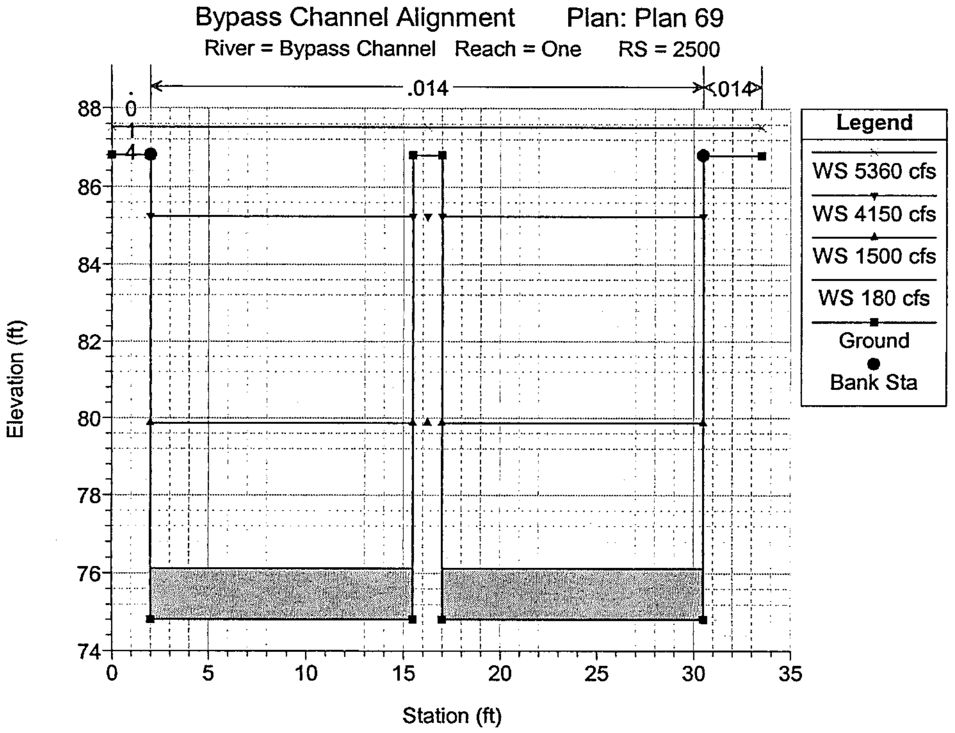
Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
One	2600	180.00	75.10	76.30		76.73	0.002128	5.25	34.30	28.50	0.84
One	2600	1500.00	75.10	80.44		81.95	0.001413	9.86	152.15	28.50	0.75
One	2600	4150.00	75.10	86.16		88.85	0.001342	13.16	315.31	28.50	0.70
One	2600	5360.00	75.10	88.45		91.49	0.001245	14.02	387.30	33.50	0.68
One	2501	180.00	74.80	76.24		76.54	0.001201	4.39	40.97	28.50	0.65
One	2501	1500.00	74.80	80.41		81.78	0.001221	9.38	159.87	28.50	0.70
One	2501	4150.00	74.80	86.12		88.69	0.001262	12.87	322.48	28.50	0.67
One	2501	5360.00	74.80	88.42		91.33	0.001163	13.73	396.24	33.50	0.66
One	2500	180.00	74.80	76.13		76.52	0.001959	5.03	35.79	27.00	0.77
One	2500	1500.00	74.80	79.87		81.73	0.002580	10.95	136.94	27.00	0.86
One	2500	4150.00	74.80	85.24		88.61	0.002931	14.72	281.96	27.00	0.80
One	2500	5360.00	74.80	87.52		91.25	0.002871	15.51	348.24	33.50	0.79
One	2450	180.00	74.70	75.81	75.81	76.37	0.003420	6.01	29.95	27.00	1.01
One	2450	1500.00	74.70	79.38	79.26	81.57	0.003223	11.87	126.39	27.00	0.97
One	2450	4150.00	74.70	84.95		88.44	0.003069	14.99	276.86	27.00	0.82
One	2450	5360.00	74.70	87.19		91.08	0.003073	15.84	340.33	33.50	0.81
One	2300	180.00	74.20	75.37	75.31	75.87	0.002928	5.72	31.47	27.00	0.93
One	2300	1500.00	74.20	78.99		81.08	0.003031	11.61	129.21	27.00	0.94
One	2300	4150.00	74.20	84.53		87.97	0.003011	14.88	278.96	27.00	0.82
One	2300	5360.00	74.20	86.77		90.60	0.003002	15.73	343.05	33.50	0.80
One	2100	180.00	73.60	74.74	74.71	75.27	0.003107	5.83	30.88	27.00	0.96
One	2100	1500.00	73.60	78.39		80.48	0.003017	11.59	129.42	27.00	0.93
One	2100	4150.00	73.60	83.94		87.37	0.003004	14.86	279.21	27.00	0.81
One	2100	5360.00	73.60	86.18		90.01	0.002988	15.70	343.59	33.50	0.80
One	1900	180.00	73.00	74.17	74.11	74.67	0.002878	5.69	31.64	27.00	0.93
One	1900	1500.00	73.00	77.81		79.88	0.002989	11.55	129.87	27.00	0.93
One	1900	4150.00	73.00	83.36		86.78	0.002991	14.84	279.67	27.00	0.81
One	1900	5360.00	73.00	85.61		89.41	0.002967	15.67	344.43	33.50	0.80
One	1700	180.00	72.40	73.53	73.51	74.07	0.003212	5.89	30.56	27.00	0.98
One	1700	1500.00	72.40	77.25	76.96	79.29	0.002923	11.46	130.90	27.00	0.92
One	1700	4150.00	72.40	82.78		86.18	0.002979	14.81	280.13	27.00	0.81
One	1700	5360.00	72.40	85.03		88.82	0.002945	15.63	345.26	33.50	0.80
One	1500	180.00	71.80	73.03	72.91	73.49	0.002466	5.42	33.24	27.00	0.86
One	1500	1500.00	71.80	76.71	76.36	78.70	0.002827	11.32	132.49	27.00	0.90
One	1500	4150.00	71.80	82.20		85.59	0.002961	14.78	280.80	27.00	0.81
One	1500	5360.00	71.80	84.46		88.23	0.002924	15.60	346.10	33.50	0.79
One	1325	180.00	71.30	72.41	72.41	72.97	0.003420	6.01	29.95	27.00	1.01
One	1325	1500.00	71.30	76.11		78.18	0.002993	11.56	129.81	27.00	0.93
One	1325	4150.00	71.30	81.65		85.07	0.002998	14.85	279.45	27.00	0.81
One	1325	5360.00	71.30	83.92		87.72	0.002954	15.65	344.93	33.50	0.80
One	1250	180.00	71.00	72.24		72.69	0.002425	5.39	33.42	27.00	0.85
One	1250	1500.00	71.00	76.00		77.92	0.002682	11.11	135.03	27.00	0.88
One	1250	4150.00	71.00	81.48		84.82	0.002904	14.66	282.99	27.00	0.80
One	1250	5360.00	71.00	83.76		87.46	0.002838	15.46	349.61	33.50	0.78
One	1100	180.00	70.60	71.75	71.71	72.27	0.003066	5.80	31.01	27.00	0.95
One	1100	1500.00	70.60	75.41		77.48	0.002989	11.55	129.86	27.00	0.93
One	1100	4150.00	70.60	80.89		84.35	0.003042	14.94	277.81	27.00	0.82
One	1100	5360.00	70.60	83.19		87.01	0.002984	15.70	343.73	33.50	0.80
One	900	180.00	70.00	71.17	71.11	71.67	0.002927	5.72	31.47	27.00	0.93
One	900	1500.00	70.00	74.82		76.88	0.002975	11.53	130.09	27.00	0.93
One	900	4150.00	70.00	80.28		83.75	0.003049	14.95	277.58	27.00	0.82
One	900	5360.00	70.00	82.55		86.40	0.003021	15.76	342.32	33.50	0.80
One	700	180.00	69.40	70.54	70.51	71.07	0.003128	5.84	30.81	27.00	0.96
One	700	1500.00	69.40	74.28		76.29	0.002875	11.39	131.70	27.00	0.91
One	700	4150.00	69.40	79.67		83.15	0.003055	14.96	277.34	27.00	0.82
One	700	5360.00	69.40	81.85		85.77	0.003105	15.89	339.15	33.50	0.81
One	500	180.00	68.80	70.00	69.91	70.48	0.002661	5.55	32.44	27.00	0.89
One	500	1500.00	68.80	73.77	73.36	75.71	0.002735	11.19	134.08	27.00	0.88

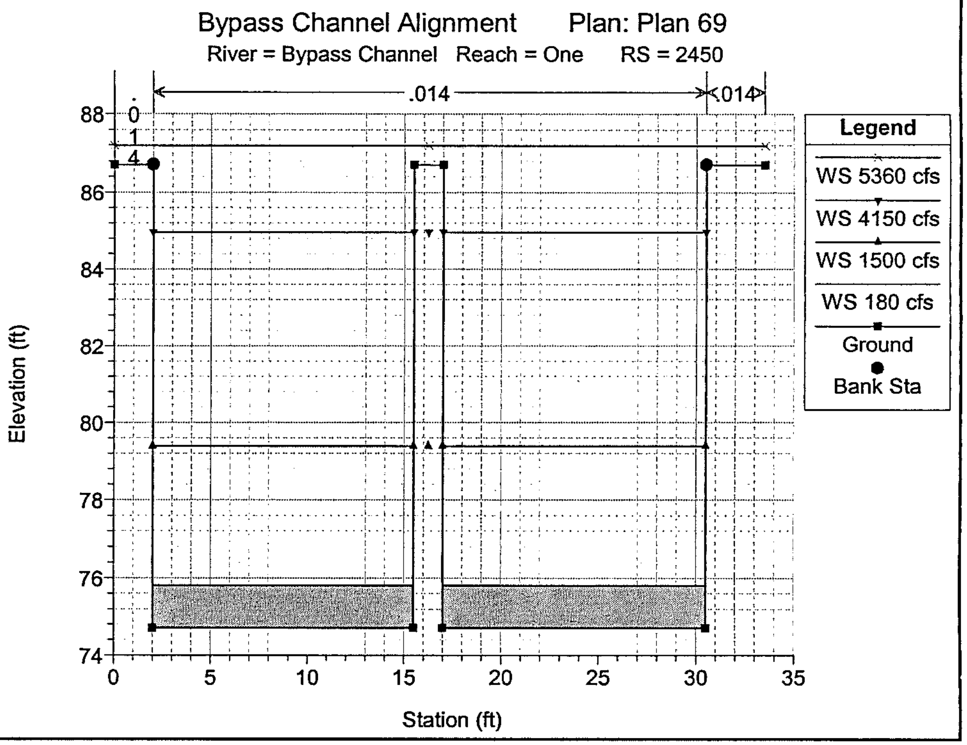
HEC-RAS Plan: Plan 68 River: Bypass Channel Reach: One (Continued)

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
One	500	4150.00	68.80	79.06	77.81	82.55	0.003062	14.98	277.11	27.00	0.82
One	500	5360.00	68.80	81.14	79.49	85.14	0.003208	16.05	335.38	33.50	0.83
One	300	180.00	68.20	69.31	69.31	69.87	0.003420	6.01	29.95	27.00	1.01
One	300	1500.00	68.20	72.76	72.76	75.06	0.003461	12.18	123.20	27.00	1.00
One	300	4150.00	68.20	77.20	77.20	81.73	0.004274	17.07	243.13	27.00	1.00
One	300	5360.00	68.20	78.89	78.89	84.25	0.004611	18.57	288.58	27.00	1.00

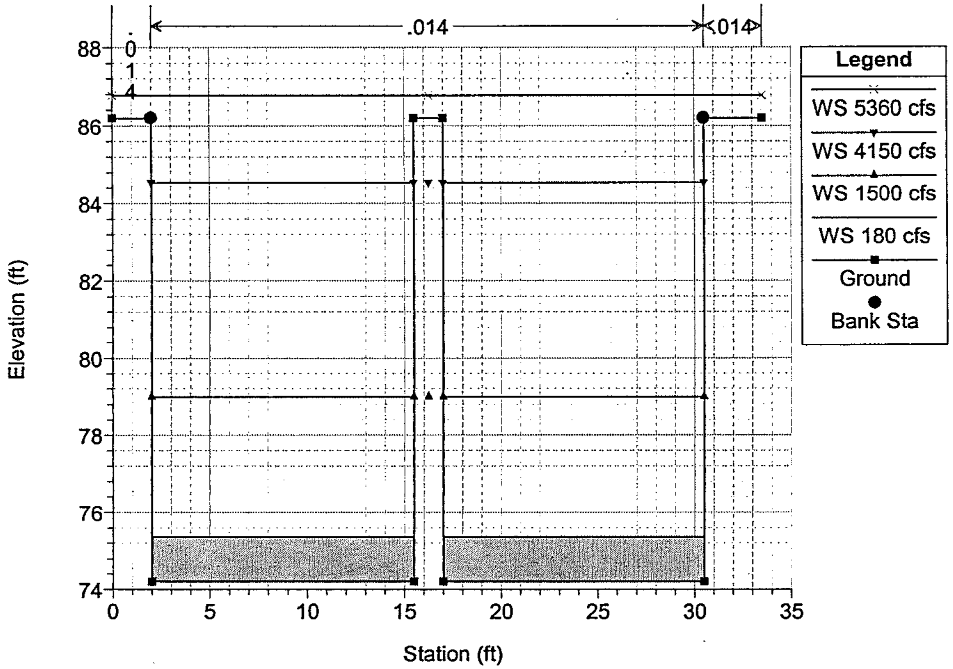

Bypass Channel Alignment Plan: Plan 69
River = Bypass Channel Reach = One RS = 2600
.014
.014
.014
Legend
WS 5360 cfs
WS 4150 cfs
WS 1500 cfs
WS 180 cfs
Ground
Bank Sta
Elevation (ft)
74
76
78
80
82
84
86
88
90
Station (ft)
0
5
10
15
20
25
30
35


Bypass Channel Alignment Plan: Plan 69
River = Bypass Channel Reach = One RS = 2501
.014
.014
.014
Legend
WS 5360 cfs
WS 4150 cfs
WS 1500 cfs
WS 180 cfs
Ground
Bank Sta
Elevation (ft)
74
76
78
80
82
84
86
88
90
Station (ft)
0
5
10
15
20
25
30
35

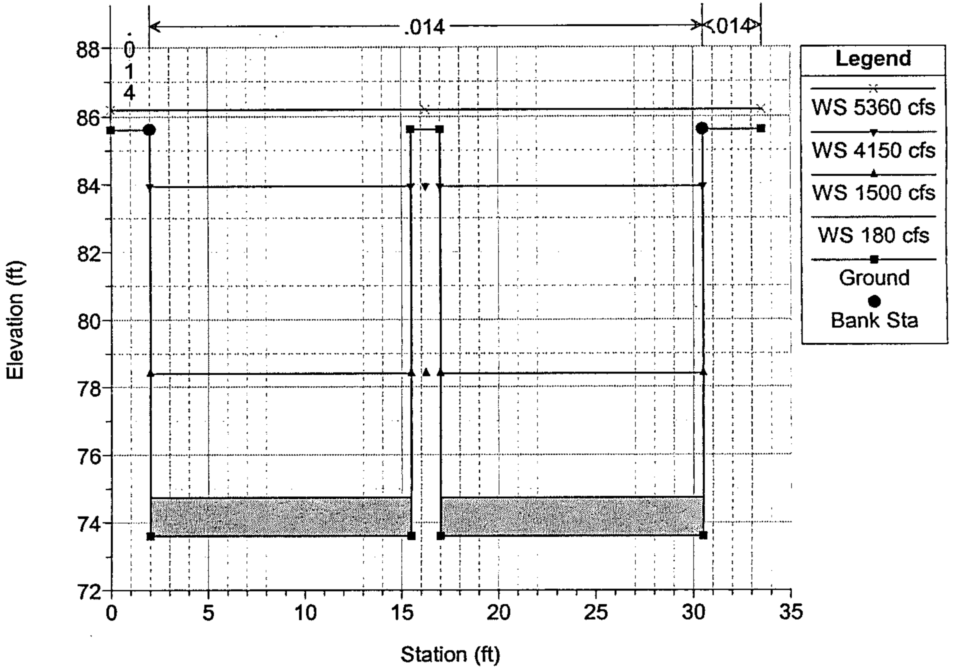

Bypass Channel Alignment Plan: Plan 69
River = Bypass Channel Reach = One RS = 2500
.014
.014
.014
Legend
WS 5360 cfs
WS 4150 cfs
WS 1500 cfs
WS 180 cfs
Ground
Bank Sta
Elevation (ft)
74
76
78
80
82
84
86
88
Station (ft)
0
5
10
15
20
25
30
35


Bypass Channel Alignment Plan: Plan 69
River = Bypass Channel Reach = One RS = 2450
.014
.014
.014
Legend
WS 5360 cfs
WS 4150 cfs
WS 1500 cfs
WS 180 cfs
Ground
Bank Sta
Elevation (ft)
74
76
78
80
82
84
86
88
Station (ft)
0
5
10
15
20
25
30
35

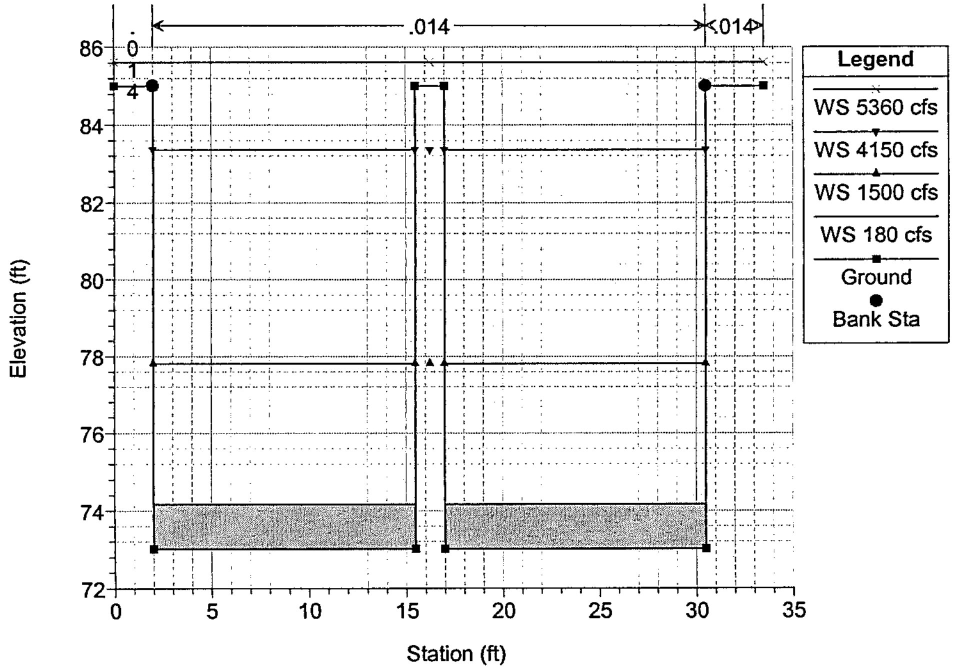
Bypass Channel Alignment Plan: Plan 69
River = Bypass Channel Reach = One RS = 2300



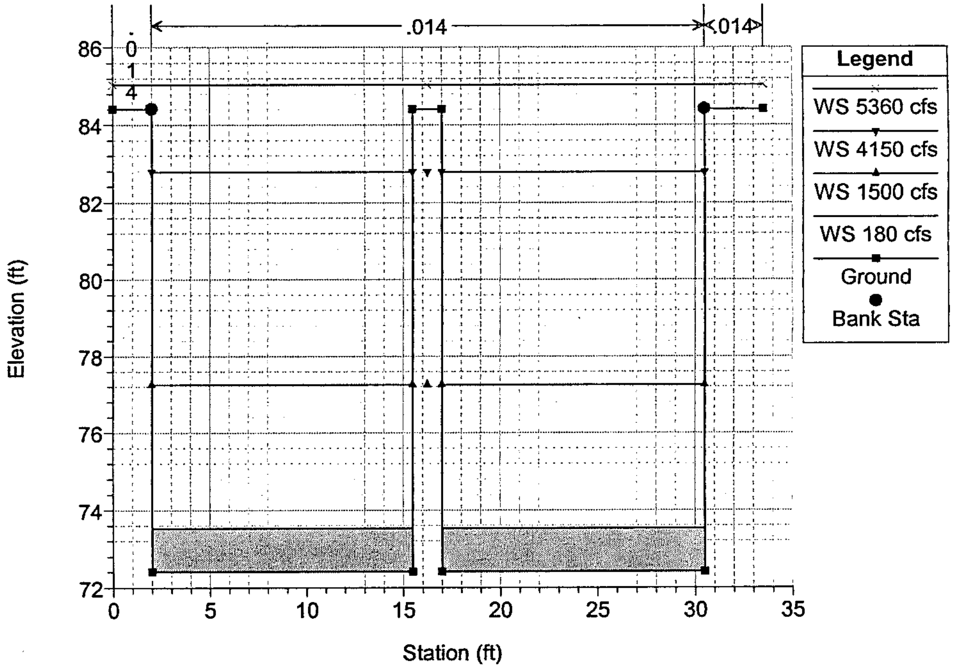
Bypass Channel Alignment Plan: Plan 69
River = Bypass Channel Reach = One RS = 2100

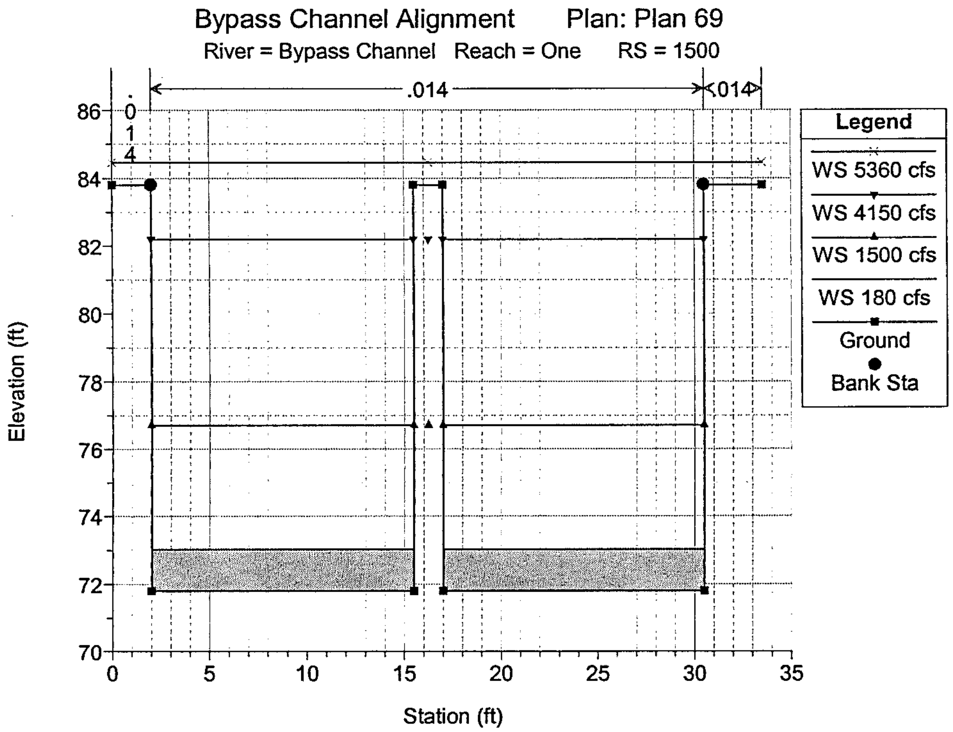


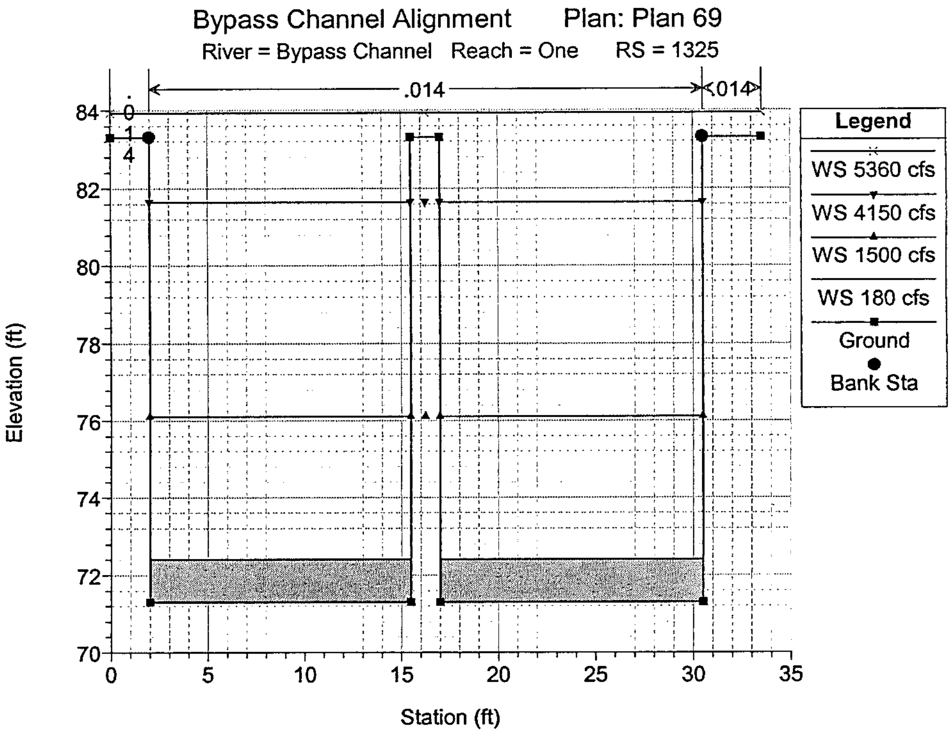
Bypass Channel Alignment Plan: Plan 69
River = Bypass Channel Reach = One RS = 1900

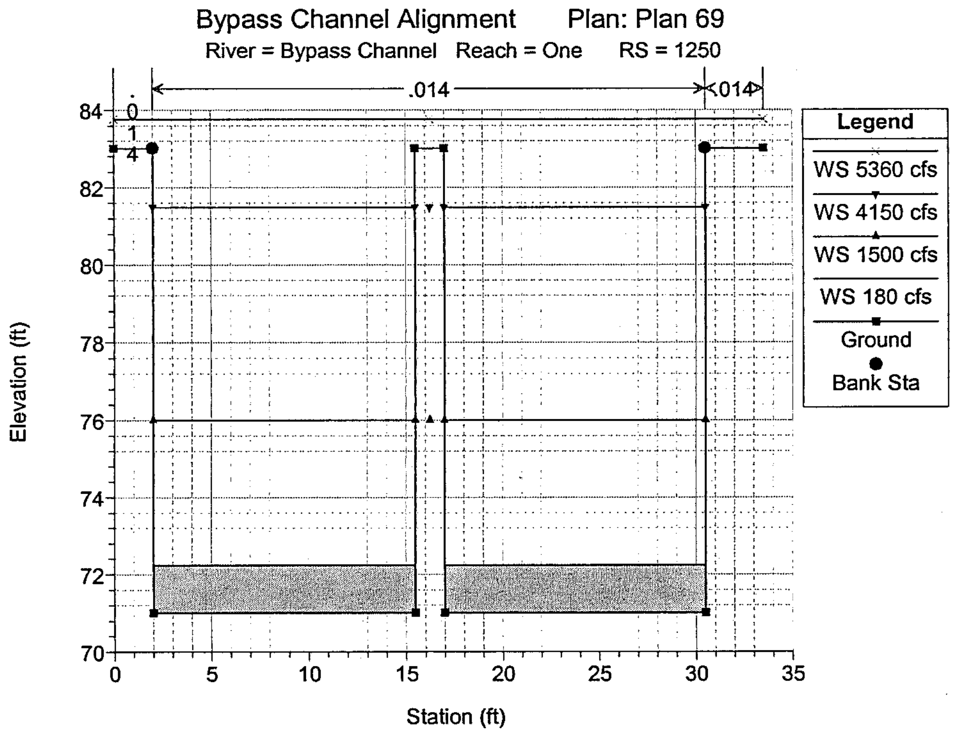


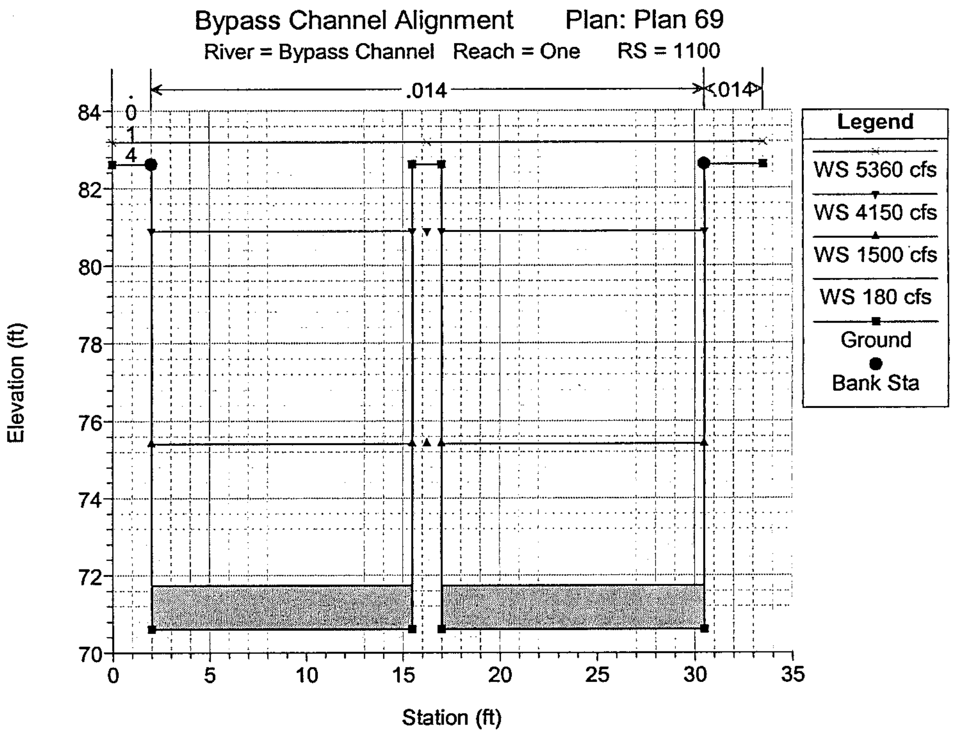
Bypass Channel Alignment Plan: Plan 69
River = Bypass Channel Reach = One RS = 1700



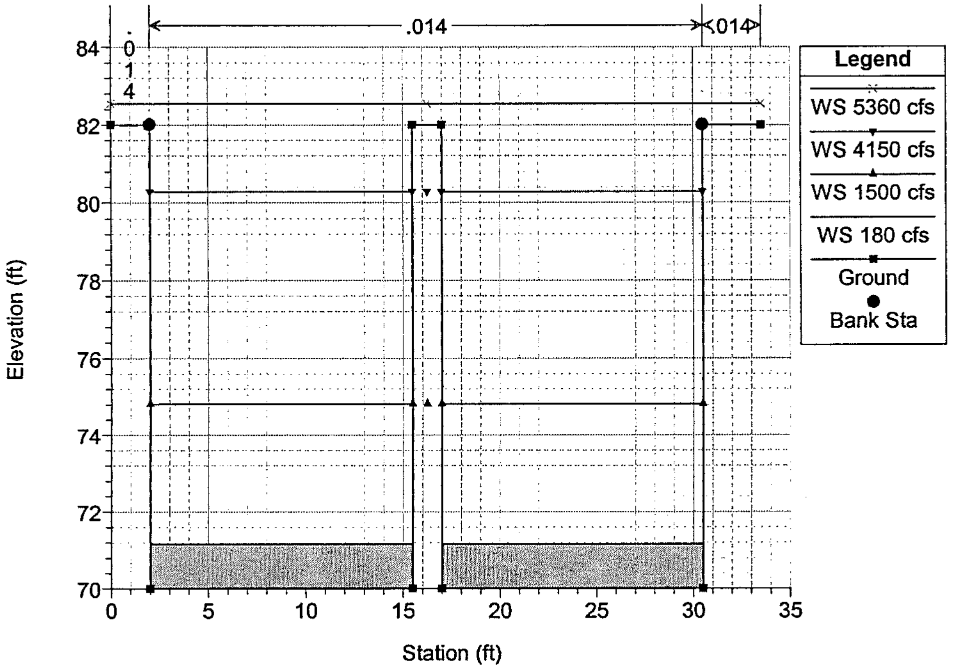

Bypass Channel Alignment Plan: Plan 69
River = Bypass Channel Reach = One RS = 1500


Bypass Channel Alignment Plan: Plan 69
River = Bypass Channel Reach = One RS = 1325

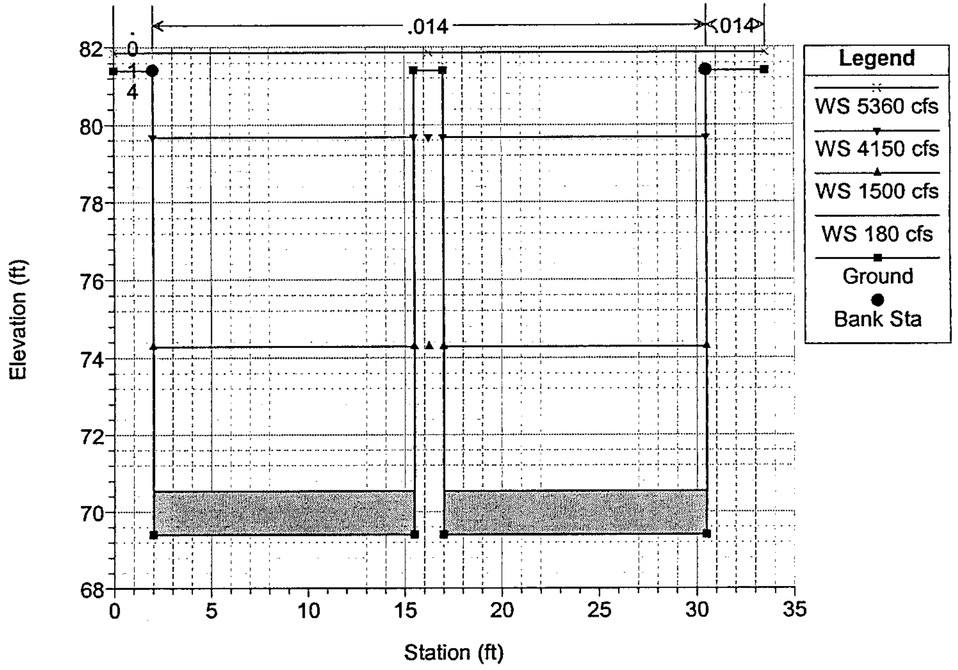

Bypass Channel Alignment Plan: Plan 69
River = Bypass Channel Reach = One RS = 1250


Bypass Channel Alignment Plan: Plan 69
River = Bypass Channel Reach = One RS = 1100

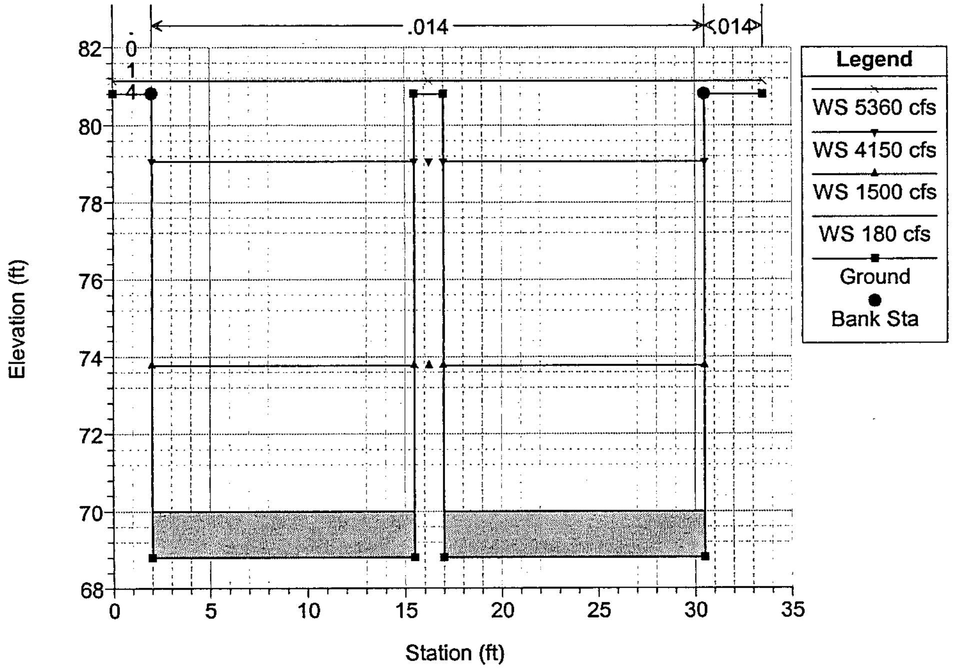
Bypass Channel Alignment Plan: Plan 69
River = Bypass Channel Reach = One RS = 900



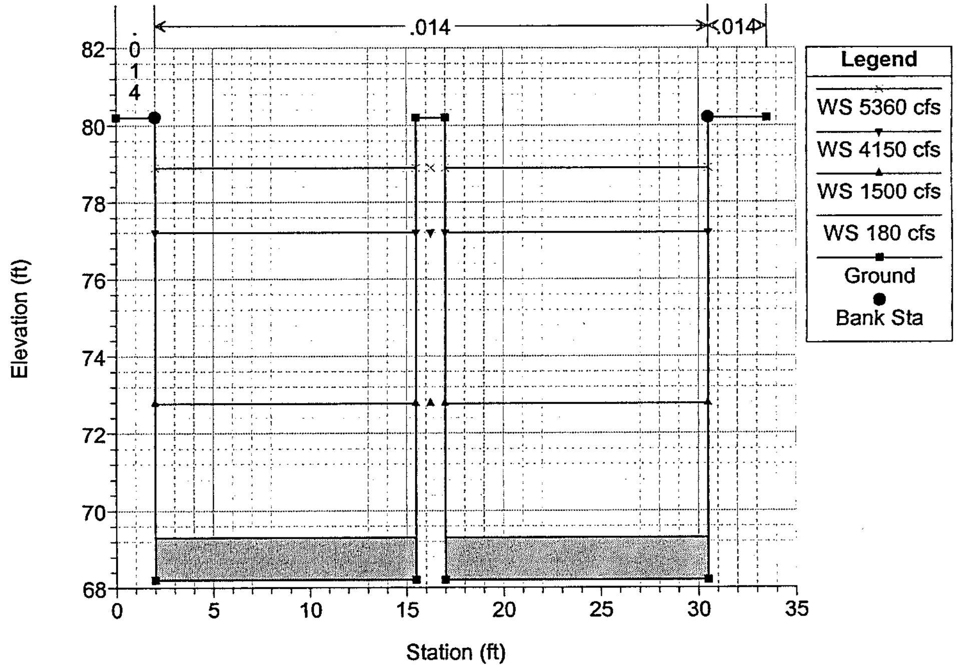
Bypass Channel Alignment Plan: Plan 69
River = Bypass Channel Reach = One RS = 700

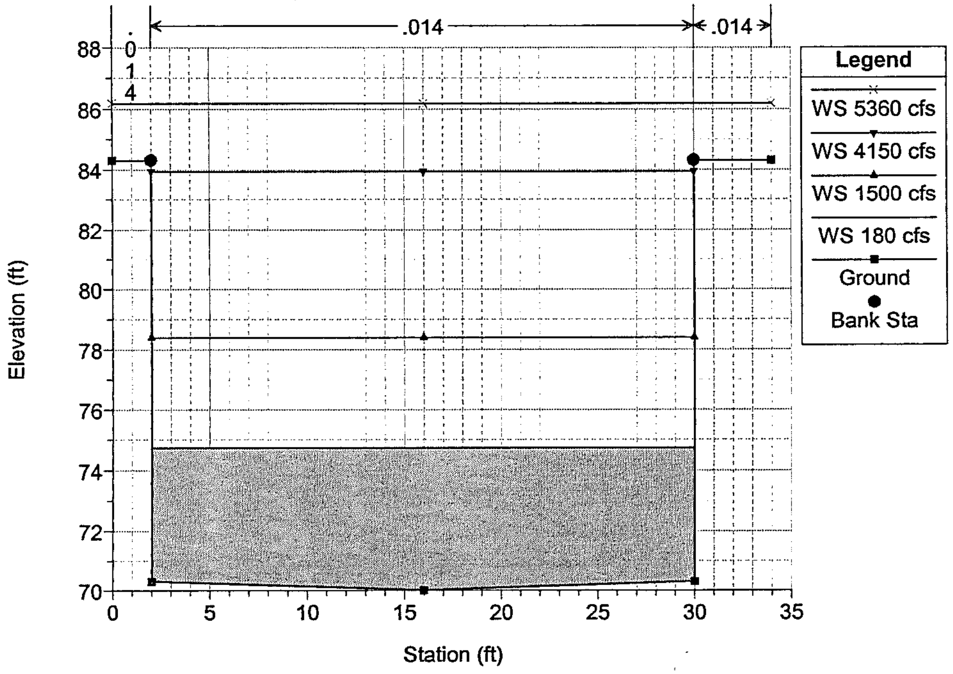


Bypass Channel Alignment Plan: Plan 69
River = Bypass Channel Reach = One RS = 500



Bypass Channel Alignment Plan: Plan 69
River = Bypass Channel Reach = One RS = 300 Mouth of channel to Coyote Creek





Bypass Channel Alignment Plan: 1) Plan 68

River = Bypass Channel Reach = One RS = 2100

UPC with Stand-Alone Weir; Q = 2-yr, 2.8-yr, 10-yr, 12.5-yr,
100-yr, and 500-yr

HEC-RAS Plan: Plan 37 River: upper penitencia Reach: three (Continued)

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
three	4313	1698.92	89.80	95.22	94.83	95.72	0.009535	6.32	306.11	148.33	0.60
three	4313	1884.90	89.80	95.33	94.94	95.88	0.010153	6.60	322.23	150.76	0.62
three	4313	4472.04	89.80	96.48	96.35	97.51	0.014517	9.12	560.53	223.83	0.77
three	4313	5940.52	89.80	97.05	96.85	98.23	0.013891	9.67	689.57	234.16	0.77
three	4305	400.00	89.80	93.74	92.36	93.81	0.001667	2.31	194.16	111.32	0.24
three	4305	589.89	89.80	94.22	92.71	94.30	0.001794	2.56	250.99	124.13	0.26
three	4305	1663.24	89.80	95.34	93.95	95.60	0.003775	4.06	406.54	155.73	0.38
three	4305	1844.23	89.80	95.46	94.09	95.75	0.004126	4.25	425.30	159.67	0.40
three	4305	4371.79	89.80	96.66	95.81	97.32	0.006750	6.17	680.82	203.70	0.52
three	4305	5807.02	89.80	97.19	96.29	98.05	0.007388	6.98	788.61	203.70	0.56
three	4295	400.00	89.81	93.73	92.35	93.79	0.001699	2.33	192.70	110.81	0.25
three	4295	585.74	89.81	94.20	92.71	94.29	0.001814	2.57	248.99	123.96	0.26
three	4295	1614.64	89.81	95.31	93.91	95.56	0.003602	4.11	401.58	153.03	0.37
three	4295	1788.96	89.81	95.42	94.07	95.71	0.003919	4.34	419.56	156.16	0.39
three	4295	4238.92	89.81	96.62	95.76	97.24	0.006484	6.13	680.13	206.78	0.51
three	4295	5632.95	89.81	97.16	96.21	97.96	0.007005	6.87	791.03	206.78	0.54
three	4285	400.00	89.82	93.71	92.35	93.78	0.001700	2.33	197.79	130.29	0.24
three	4285	580.90	89.82	94.19	92.70	94.27	0.001763	2.52	266.50	149.45	0.25
three	4285	1564.59	89.82	95.31	93.86	95.51	0.002737	3.56	442.08	165.46	0.32
three	4285	1732.09	89.82	95.43	94.09	95.65	0.002929	3.73	462.32	167.24	0.34
three	4285	4103.00	89.82	96.66	95.31	97.15	0.004645	5.33	742.47	209.86	0.44
three	4285	5454.43	89.82	97.22	96.00	97.86	0.005109	6.03	859.18	209.86	0.47
three	4275	400.00	89.79	93.71	92.01	93.76	0.000978	1.77	235.15	120.30	0.19
three	4275	575.23	89.79	94.19	92.31	94.25	0.001129	2.02	296.77	143.38	0.20
three	4275	1512.09	89.79	95.32	93.40	95.47	0.002069	3.10	485.06	174.09	0.28
three	4275	1672.36	89.79	95.44	93.55	95.61	0.002199	3.23	507.26	175.07	0.29
three	4275	3961.02	89.79	96.70	95.05	97.07	0.003650	4.84	814.97	235.00	0.39
three	4275	5267.65	89.79	97.28	95.64	97.76	0.003906	5.40	950.32	235.00	0.41
three	4265	400.00	89.69	93.71	91.27	93.74	0.000517	1.31	278.62	112.32	0.14
three	4265	568.71	89.69	94.18	91.59	94.22	0.000776	1.70	343.25	172.14	0.17
three	4265	1457.12	89.69	95.32	92.76	95.43	0.001292	2.50	552.81	194.43	0.22
three	4265	1609.71	89.69	95.46	92.92	95.58	0.001381	2.62	578.75	196.97	0.23
three	4265	3812.88	89.69	96.74	94.69	97.02	0.002327	4.05	917.31	240.00	0.31
three	4265	5072.79	89.69	97.33	95.23	97.69	0.002581	4.59	1058.56	240.00	0.34
three	4255	400.00	89.59	93.70	91.24	93.73	0.000499	1.31	282.75	113.07	0.13
three	4255	561.28	89.59	94.17	91.54	94.21	0.000732	1.69	346.89	172.37	0.16
three	4255	1400.09	89.59	95.31	92.66	95.41	0.001170	2.43	554.87	192.95	0.21
three	4255	1544.45	89.59	95.45	92.81	95.56	0.001235	2.53	582.71	195.72	0.22
three	4255	3660.53	89.59	96.73	94.59	96.98	0.002115	3.97	922.19	240.00	0.30
three	4255	4872.79	89.59	97.32	95.12	97.65	0.002354	4.48	1063.40	240.00	0.32
three	4245	400.00	89.44	93.70	91.21	93.73	0.000485	1.31	285.67	113.22	0.13
three	4245	560.89	89.44	94.17	91.52	94.21	0.000717	1.70	349.11	172.59	0.16
three	4245	1397.20	89.44	95.30	92.62	95.40	0.001223	2.53	558.72	202.88	0.22
three	4245	1541.12	89.44	95.45	92.78	95.55	0.001180	2.54	626.14	235.19	0.22
three	4245	3652.85	89.44	96.71	94.57	96.95	0.002072	4.00	926.35	240.00	0.30
three	4245	4862.72	89.44	97.29	95.37	97.62	0.002319	4.52	1066.34	240.00	0.32
three	4244.5	Lat. Weir									
three	4235	399.43	89.29	93.39	92.18	93.69	0.006186	4.53	100.47	72.22	0.47
three	4235	549.67	89.29	93.86	92.96	94.16	0.005985	4.76	139.96	96.82	0.47
three	4235	1340.53	89.29	94.82	94.47	95.33	0.009091	6.61	257.54	153.65	0.59
three	4235	1476.51	89.29	94.93	94.56	95.48	0.009686	6.92	274.09	157.19	0.61
three	4235	3511.19	89.29	96.08	95.73	96.85	0.009944	8.23	515.44	194.56	0.64
three	4235	4681.95	89.29	96.54	96.16	97.51	0.011075	9.19	605.42	202.86	0.69
three	4225	399.25	89.14	93.28	92.13	93.61	0.007030	4.78	93.24	65.87	0.50
three	4225	538.82	89.14	93.76	92.76	94.09	0.006475	4.92	131.43	91.43	0.48
three	4225	1286.32	89.14	94.76	94.43	95.24	0.008721	6.46	253.57	154.72	0.58
three	4225	1415.73	89.14	94.85	94.56	95.38	0.009463	6.81	268.17	157.08	0.60
three	4225	3373.95	89.14	96.03	95.64	96.75	0.009298	7.95	512.51	193.62	0.62
three	4225	4510.34	89.14	96.47	96.04	97.39	0.010586	8.96	598.50	201.60	0.67
three	4215	398.52	88.97	93.16	91.99	93.53	0.007649	5.02	86.84	58.88	0.52
three	4215	525.84	88.97	93.65	92.45	94.01	0.006911	5.10	122.34	85.19	0.50

HEC-RAS Plan: Plan 37 River: upper penitencia Reach: three (Continued)

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
three	4215	1226.35	88.97	94.70	94.35	95.16	0.008469	6.29	248.22	150.64	0.57
three	4215	1348.82	88.97	94.80	94.44	95.29	0.008837	6.52	263.95	155.69	0.58
three	4215	3227.69	88.97	95.98	95.55	96.65	0.008808	7.65	506.77	192.91	0.61
three	4215	4330.52	88.97	96.40	95.96	97.28	0.010241	8.70	588.83	200.34	0.66
three	4205	397.39	88.81	92.99	91.91	93.44	0.009084	5.43	77.71	49.38	0.56
three	4205	511.26	88.81	93.51	92.35	93.92	0.007934	5.37	111.38	80.73	0.53
three	4205	1159.96	88.81	94.64	94.27	95.06	0.008124	6.03	243.90	147.70	0.55
three	4205	1274.62	88.81	94.75	94.36	95.20	0.008295	6.19	261.00	152.76	0.56
three	4205	3071.91	88.81	95.94	95.41	96.56	0.008310	7.30	500.84	192.67	0.59
three	4205	4142.35	88.81	96.33	95.89	97.17	0.009955	8.41	577.38	199.08	0.65
three	4195	396.79	88.64	92.74	91.88	93.32	0.012172	6.13	66.07	36.51	0.65
three	4195	496.14	88.64	93.35	92.28	93.82	0.009513	5.73	99.86	74.67	0.58
three	4195	1086.80	88.64	94.58	94.18	94.97	0.007732	5.72	238.43	144.88	0.54
three	4195	1192.75	88.64	94.71	94.28	95.10	0.007713	5.82	256.87	150.08	0.54
three	4195	2905.85	88.64	95.91	95.45	96.47	0.007737	6.90	495.19	192.49	0.56
three	4195	3945.93	88.64	96.26	95.80	97.06	0.009692	8.11	564.42	197.82	0.64
three	4190	396.79	88.60	92.22	92.13	93.20	0.027448	7.93	50.07	23.26	0.95
three	4190	493.54	88.60	92.51	92.51	93.68	0.029688	8.68	56.86	24.80	1.00
three	4190	1053.25	88.60	94.17	94.17	94.89	0.014282	7.56	171.87	111.76	0.73
three	4190	1155.07	88.60	94.29	94.29	95.02	0.014412	7.70	185.61	116.71	0.74
three	4190	2824.89	88.60	95.57	95.57	96.40	0.014177	8.70	416.16	220.66	0.75
three	4190	3850.24	88.60	95.96	95.96	96.97	0.015148	9.53	500.69	222.76	0.79
three	4185	396.72	88.48	92.68	92.11	92.91	0.005979	4.22	106.39	64.34	0.45
three	4185	492.52	88.48	92.91	92.30	93.18	0.006488	4.48	121.79	68.60	0.47
three	4185	1028.49	88.48	93.79	93.13	94.25	0.008774	5.58	189.19	84.78	0.56
three	4185	1126.83	88.48	93.91	93.26	94.41	0.009168	5.76	199.23	86.93	0.57
three	4185	2744.86	88.48	95.70	94.88	96.18	0.006768	6.16	508.85	202.00	0.52
three	4185	3754.38	88.48	96.11	95.52	96.76	0.007836	7.04	591.68	202.00	0.57
three	4175	395.17	88.38	92.52	92.11	92.84	0.008307	4.92	92.88	59.51	0.53
three	4175	485.65	88.38	92.76	92.31	93.10	0.008649	5.13	108.01	65.61	0.54
three	4175	985.88	88.38	93.66	93.16	94.15	0.010412	6.03	177.80	90.00	0.61
three	4175	1077.36	88.38	93.79	93.28	94.30	0.010596	6.15	189.49	93.47	0.61
three	4175	2587.55	88.38	95.26	94.77	96.06	0.011736	7.73	364.03	142.68	0.67
three	4175	3558.61	88.38	95.80	95.53	96.65	0.011305	8.16	493.70	183.00	0.67
three	4165	393.47	88.28	92.36	92.04	92.74	0.009874	5.34	85.64	57.47	0.57
three	4165	478.09	88.28	92.62	92.25	93.01	0.009595	5.43	101.28	61.12	0.57
three	4165	941.30	88.28	93.53	93.07	94.04	0.010846	6.18	166.68	83.49	0.62
three	4165	1025.55	88.28	93.66	93.19	94.19	0.010972	6.28	177.62	86.59	0.62
three	4165	2437.68	88.28	95.17	94.66	95.94	0.011238	7.67	350.73	139.42	0.66
three	4165	3364.95	88.28	95.72	95.52	96.52	0.010936	8.11	481.18	183.00	0.66
three	4155	393.38	88.18	92.11	91.90	92.61	0.012824	6.07	75.16	54.75	0.65
three	4155	477.69	88.18	92.42	92.18	92.89	0.011485	5.99	93.01	59.81	0.62
three	4155	939.04	88.18	93.01	93.01	93.86	0.018907	8.13	131.52	70.04	0.81
three	4155	1022.93	88.18	93.13	93.13	94.01	0.019318	8.27	139.72	72.22	0.82
three	4155	2430.06	88.18	94.64	94.64	95.76	0.017588	9.34	290.03	128.75	0.82
three	4155	3355.08	88.18	95.51	95.51	96.40	0.012804	8.76	458.76	189.00	0.71
three	4145	393.38	88.08	92.00	91.76	92.47	0.011761	5.87	79.79	66.00	0.63
three	4145	477.69	88.08	92.43	91.99	92.74	0.007753	5.04	121.24	99.57	0.51
three	4145	939.04	88.08	93.08	92.77	93.50	0.009536	5.99	189.88	112.58	0.58
three	4145	1022.93	88.08	93.19	92.86	93.62	0.009622	6.06	201.89	114.88	0.58
three	4145	2430.06	88.08	94.66	93.96	95.24	0.007698	6.48	398.04	138.78	0.55
three	4145	3355.08	88.08	95.64	94.46	96.17	0.005059	5.81	588.91	175.00	0.45
three	4144.5	Lat. Weir									
three	4135	393.38	87.98	91.86	91.48	92.37	0.011854	5.94	76.49	60.67	0.63
three	4135	471.72	87.98	92.28	91.88	92.65	0.008605	5.34	112.17	98.17	0.55
three	4135	908.75	87.98	92.98	92.70	93.40	0.009334	6.03	185.72	112.79	0.58
three	4135	988.76	87.98	93.06	92.80	93.51	0.009712	6.20	195.04	115.55	0.59
three	4135	2306.12	87.98	94.65	93.82	95.15	0.006266	6.09	409.60	138.60	0.50
three	4135	3155.79	87.98	95.65	94.27	96.09	0.004096	5.44	604.89	175.00	0.41
three	4125	393.38	87.94	91.44	90.99	92.19	0.017832	7.03	59.16	40.83	0.77
three	4125	470.28	87.94	91.70	91.70	92.49	0.017971	7.33	71.45	53.40	0.78

HEC-RAS Plan: Plan 37 River: upper penitencia Reach: three (Continued)

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
three	4125	882.65	87.94	92.65	92.65	93.27	0.013638	7.19	154.78	106.26	0.70
three	4125	958.54	87.94	92.75	92.71	93.38	0.013757	7.29	164.82	108.17	0.70
three	4125	2169.19	87.94	94.65	93.74	95.07	0.005358	5.68	415.17	139.35	0.46
three	4125	2937.44	87.94	95.65	94.15	96.03	0.003566	4.92	605.97	175.00	0.38
three	4115	393.38	87.90	91.43	90.83	91.98	0.012822	6.13	72.17	55.84	0.66
three	4115	470.28	87.90	91.71	91.47	92.24	0.012119	6.20	89.45	69.37	0.64
three	4115	860.30	87.90	92.61	92.37	93.07	0.009744	6.21	170.16	102.78	0.59
three	4115	930.49	87.90	92.77	92.45	93.21	0.008860	6.03	187.35	105.52	0.57
three	4115	2025.15	87.90	94.65	93.46	94.99	0.004130	5.03	432.68	139.98	0.40
three	4115	2710.10	87.90	95.66	93.89	95.97	0.002850	4.31	618.69	175.00	0.34
three	4105	393.38	87.86	91.36	90.59	91.84	0.010939	5.72	77.14	57.95	0.61
three	4105	470.28	87.86	91.65	91.18	92.11	0.010314	5.80	95.73	72.64	0.60
three	4105	834.91	87.86	92.58	92.18	92.96	0.007616	5.60	179.80	98.23	0.53
three	4105	898.52	87.86	92.73	92.25	93.10	0.007069	5.48	194.65	99.56	0.51
three	4105	1874.28	87.86	94.64	93.17	94.94	0.003459	4.75	423.12	125.75	0.37
three	4105	2474.53	87.86	95.65	93.64	95.94	0.002569	4.10	588.29	160.00	0.32
three	4095	393.33	87.81	91.64	89.31	91.69	0.001028	1.79	219.49	81.18	0.19
three	4095	467.87	87.81	91.91	89.45	91.96	0.001115	1.93	241.81	84.73	0.20
three	4095	802.26	87.81	92.75	90.03	92.84	0.001516	2.53	317.62	93.86	0.24
three	4095	859.42	87.81	92.88	90.12	92.99	0.001529	2.60	330.63	94.03	0.24
three	4095	1713.90	87.81	94.70	91.26	94.88	0.001639	3.40	504.03	98.88	0.27
three	4095	2229.41	87.81	95.68	91.82	95.88	0.001616	3.62	630.52	130.00	0.27
three	4085	392.67	87.72	91.56	89.87	91.66	0.003702	2.60	150.97	85.12	0.34
three	4085	461.51	87.72	91.83	90.05	91.94	0.003748	2.62	176.48	99.86	0.35
three	4085	762.75	87.72	92.69	90.68	92.82	0.002850	2.83	269.19	109.21	0.32
three	4085	813.25	87.72	92.84	90.77	92.96	0.002697	2.86	284.78	109.38	0.31
three	4085	1543.68	87.72	94.70	92.06	94.86	0.001728	3.14	492.05	115.45	0.27
three	4085	1973.85	87.72	95.70	92.39	95.85	0.001475	3.18	634.25	145.00	0.25
three	4075	392.54	87.73	91.26	89.95	91.59	0.006354	4.62	84.91	28.59	0.47
three	4075	458.12	87.73	91.46	90.17	91.86	0.007121	5.05	90.74	29.07	0.50
three	4075	736.93	87.73	91.94	91.00	92.70	0.012122	7.04	104.75	30.17	0.67
three	4075	782.97	87.73	92.01	91.12	92.84	0.012816	7.31	107.14	30.35	0.69
three	4075	1436.13	87.73	92.75	92.65	94.64	0.024543	11.02	130.27	32.08	0.96
three	4075	1806.86	87.73	93.37	93.37	95.61	0.025778	12.01	150.39	33.51	1.00
three	4065	392.54	87.73	91.23	89.83	91.52	0.005480	4.32	90.97	30.61	0.44
three	4065	458.07	87.73	91.43	90.04	91.77	0.006131	4.71	97.21	31.09	0.47
three	4065	736.28	87.73	91.90	90.83	92.57	0.010412	6.57	112.12	32.18	0.62
three	4065	782.21	87.73	91.97	90.95	92.69	0.011138	6.85	114.20	32.33	0.64
three	4065	1433.65	87.73	92.64	92.41	94.35	0.022422	10.50	136.58	34.20	0.93
three	4065	1802.66	87.73	93.12	93.12	95.26	0.025655	11.75	153.47	35.81	1.00
three	4064.5	Lat. Weir									
three	4055	392.54	87.73	91.19	89.73	91.45	0.004800	4.05	96.87	32.64	0.41
three	4055	456.26	87.73	91.40	89.93	91.70	0.005331	4.41	103.54	33.19	0.44
three	4055	721.74	87.73	91.88	90.65	92.44	0.008750	6.02	119.94	34.80	0.57
three	4055	765.34	87.73	91.95	90.76	92.55	0.009317	6.26	122.24	35.01	0.59
three	4055	1384.38	87.73	92.70	92.10	94.03	0.017059	9.27	149.28	36.85	0.81
three	4055	1733.24	87.73	93.03	92.74	94.81	0.021278	10.73	161.60	37.65	0.91
three	4045	392.54	87.74	91.16		91.39	0.004296	3.82	102.68	34.86	0.39
three	4045	453.94	87.74	91.36		91.63	0.004705	4.13	109.81	35.35	0.41
three	4045	705.27	87.74	91.86		92.33	0.007295	5.53	127.55	36.55	0.52
three	4045	746.27	87.74	91.93		92.44	0.007720	5.74	130.01	36.72	0.54
three	4045	1327.23	87.74	92.73		93.79	0.013225	8.27	160.41	38.68	0.72
three	4045	1656.91	87.74	93.12		94.50	0.015880	9.44	175.54	39.63	0.79
three	4035	392.53	87.75	91.13		91.34	0.003937	3.65	107.54	36.52	0.37
three	4035	451.19	87.75	91.33		91.57	0.004254	3.92	115.02	37.01	0.39
three	4035	687.60	87.75	91.84		92.25	0.006273	5.13	134.00	38.24	0.48
three	4035	725.85	87.75	91.91		92.34	0.006599	5.31	136.64	38.41	0.50
three	4035	1265.44	87.75	92.76		93.61	0.010524	7.43	170.21	40.48	0.64
three	4035	1572.33	87.75	93.18		94.27	0.012632	8.37	187.88	42.81	0.70
three	4025	392.45	87.48	91.08		91.30	0.003983	3.69	106.50	35.83	0.38
three	4025	448.10	87.48	91.29		91.53	0.004258	3.94	113.81	36.31	0.39

HEC-RAS Plan: Plan 37 River: upper penitencia Reach: three (Continued)

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
three	4025	669.28	87.48	91.78		92.18	0.006112	5.07	132.06	37.48	0.48
three	4025	704.75	87.48	91.85		92.27	0.006409	5.24	134.57	37.64	0.49
three	4025	1201.62	87.48	92.69		93.50	0.009863	7.19	167.22	39.65	0.62
three	4025	1484.18	87.48	93.12		94.13	0.011397	8.05	184.26	40.79	0.67
three	4015	392.40	87.19	91.01		91.25	0.004588	3.96	98.99	33.66	0.41
three	4015	445.18	87.19	91.21		91.48	0.004870	4.21	105.69	34.20	0.42
three	4015	651.94	87.19	91.68		92.12	0.006836	5.34	122.05	35.32	0.51
three	4015	684.77	87.19	91.74		92.21	0.007151	5.51	124.28	35.47	0.52
three	4015	1141.69	87.19	92.51		93.38	0.010974	7.49	152.44	37.31	0.65
three	4015	1401.17	87.19	92.91		94.00	0.012759	8.37	167.39	38.60	0.71
three	4005	392.40	86.89	90.93	89.41	91.20	0.004800	4.12	95.22	31.46	0.42
three	4005	442.69	86.89	91.12	89.57	91.42	0.005099	4.37	101.32	31.99	0.43
three	4005	636.08	86.89	91.58	90.16	92.05	0.007066	5.47	116.28	33.25	0.52
three	4005	666.46	86.89	91.64	90.24	92.14	0.007386	5.63	118.28	33.41	0.53
three	4005	1087.21	86.89	92.38	91.26	93.27	0.011219	7.57	143.61	35.27	0.66
three	4005	1325.36	86.89	92.76	91.77	93.87	0.012857	8.43	157.24	36.22	0.71
three	3995	392.40	86.59	90.84	89.38	91.14	0.005393	4.38	89.59	29.32	0.44
three	3995	440.81	86.59	91.03	89.55	91.36	0.005728	4.64	95.06	29.79	0.46
three	3995	622.30	86.59	91.45	90.11	91.97	0.007939	5.77	107.83	30.88	0.54
three	3995	650.44	86.59	91.51	90.19	92.05	0.008287	5.94	109.56	31.04	0.56
three	3995	1039.57	86.59	92.15	91.21	93.14	0.013014	8.00	130.03	32.81	0.71
three	3995	1259.07	86.59	92.47	91.70	93.71	0.015241	8.94	140.82	33.70	0.77
three	3988	392.40	86.50	90.86	89.34	91.09	0.004130	3.79	103.49	35.17	0.39
three	3988	439.36	86.50	91.06	89.48	91.30	0.004282	3.98	110.31	35.68	0.40
three	3988	612.46	86.50	91.51	89.94	91.87	0.005507	4.83	126.86	36.89	0.46
three	3988	638.97	86.50	91.57	90.01	91.95	0.005684	4.95	129.16	37.06	0.47
three	3988	1005.47	86.50	92.33	90.84	92.96	0.007811	6.36	158.01	39.08	0.56
three	3988	1211.39	86.50	92.73	91.26	93.49	0.008592	6.97	173.90	40.14	0.59
three	3985	392.40	86.55	90.79	89.26	91.07	0.005063	4.28	91.66	29.71	0.43
three	3985	438.76	86.55	90.96	89.43	91.28	0.005409	4.53	96.77	30.15	0.45
three	3985	608.43	86.55	91.36	89.96	91.84	0.007392	5.59	108.92	31.18	0.53
three	3985	634.26	86.55	91.41	90.03	91.92	0.007697	5.74	110.55	31.31	0.54
three	3985	991.75	86.55	91.97	90.98	92.89	0.012224	7.72	128.55	32.77	0.69
three	3985	1192.30	86.55	92.25	91.44	93.41	0.014481	8.65	137.86	33.49	0.75
three	3975	392.40	86.56	90.73	89.23	91.01	0.005152	4.26	92.19	30.72	0.43
three	3975	437.47	86.56	90.90	89.39	91.22	0.005442	4.49	97.46	31.16	0.45
three	3975	597.43	86.56	91.29	89.91	91.75	0.007161	5.44	109.87	32.17	0.52
three	3975	621.32	86.56	91.35	89.98	91.83	0.007417	5.57	111.52	32.30	0.53
three	3975	954.82	86.56	91.91	90.85	92.74	0.011231	7.34	130.11	33.75	0.66
three	3975	1141.58	86.56	92.20	91.27	93.23	0.013032	8.16	139.94	34.49	0.71
three	3965	392.40	86.67	90.67	89.24	90.96	0.005435	4.31	91.05	31.09	0.44
three	3965	436.23	86.67	90.84	89.39	91.16	0.005702	4.53	96.39	31.64	0.46
three	3965	586.92	86.67	91.22	89.86	91.67	0.007360	5.41	108.48	32.87	0.52
three	3965	608.93	86.67	91.27	89.94	91.74	0.007594	5.53	110.10	33.03	0.53
three	3965	918.36	86.67	91.84	90.76	92.62	0.010838	7.10	129.35	34.56	0.65
three	3965	1091.21	86.67	92.13	91.16	93.08	0.012266	7.81	139.63	35.30	0.69
three	3955	392.40	86.78	90.62	89.23	90.91	0.005610	4.34	90.36	31.26	0.45
three	3955	434.97	86.78	90.79	89.37	91.11	0.005835	4.54	95.72	31.81	0.46
three	3955	576.93	86.78	91.14	89.81	91.59	0.007390	5.38	107.30	32.94	0.53
three	3955	597.11	86.78	91.19	89.87	91.66	0.007595	5.49	108.86	33.09	0.53
three	3955	882.32	86.78	91.77	90.63	92.50	0.010347	6.87	128.42	34.92	0.63
three	3955	1041.16	86.78	92.07	91.00	92.94	0.011495	7.49	139.06	35.88	0.67
three	3945	392.40	86.80	90.56	89.20	90.85	0.005734	4.37	89.84	31.34	0.45
three	3945	434.91	86.80	90.73	89.35	91.05	0.005953	4.57	95.21	31.88	0.47
three	3945	576.44	86.80	91.07	89.79	91.52	0.007623	5.43	106.25	32.97	0.53
three	3945	596.54	86.80	91.11	89.84	91.59	0.007843	5.54	107.74	33.11	0.54
three	3945	880.54	86.80	91.61	90.59	92.39	0.011271	7.07	124.61	34.69	0.66
three	3945	1038.68	86.80	91.87	90.96	92.81	0.012819	7.76	133.77	35.52	0.71
three	3944.5	Lat. Weir									
three	3935	392.40	86.70	90.50	89.15	90.80	0.005768	4.37	89.76	31.42	0.46
three	3935	433.78	86.70	90.67	89.29	90.99	0.005954	4.56	95.14	31.96	0.47

HEC-RAS Plan: Plan 37 River: upper penitencia Reach: three (Continued)

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
three	3935	567.61	86.70	91.00	89.71	91.45	0.007455	5.35	106.04	33.03	0.53
three	3935	586.73	86.70	91.05	89.76	91.51	0.007660	5.46	107.50	33.17	0.53
three	3935	852.14	86.70	91.54	90.46	92.27	0.010710	6.87	124.10	34.73	0.64
three	3935	1000.20	86.70	91.79	90.81	92.67	0.012160	7.53	132.82	35.52	0.69
three	3925	392.40	86.57	90.39	89.15	90.73	0.006876	4.68	83.79	30.17	0.50
three	3925	433.03	86.57	90.55	89.29	90.92	0.007101	4.88	88.82	30.80	0.51
three	3925	559.79	86.57	90.86	89.71	91.36	0.008879	5.69	98.45	31.98	0.57
three	3925	577.94	86.57	90.90	89.77	91.42	0.009128	5.80	99.72	32.13	0.58
three	3925	825.98	86.57	91.32	90.46	92.14	0.012963	7.28	113.53	33.73	0.70
three	3925	964.67	86.57	91.51	90.81	92.51	0.015085	8.03	120.18	34.47	0.76
three	3915	392.40	86.39	90.35	88.92	90.66	0.005835	4.47	87.87	29.91	0.46
three	3915	432.56	86.39	90.52	89.06	90.85	0.006078	4.66	92.84	30.54	0.47
three	3915	553.08	86.39	90.82	89.47	91.27	0.007572	5.40	102.34	31.70	0.53
three	3915	570.29	86.39	90.86	89.52	91.33	0.007782	5.50	103.60	31.85	0.54
three	3915	803.22	86.39	91.26	90.20	91.99	0.011135	6.89	116.53	33.36	0.65
three	3915	933.94	86.39	91.45	90.55	92.34	0.012995	7.60	122.88	34.08	0.71
three	3905	392.40	86.21	90.32	88.73	90.60	0.004826	4.19	93.65	30.39	0.42
three	3905	431.80	86.21	90.49	88.87	90.79	0.005020	4.37	98.72	30.87	0.43
three	3905	545.67	86.21	90.80	89.25	91.19	0.006130	5.04	108.36	31.74	0.48
three	3905	561.94	86.21	90.84	89.31	91.25	0.006288	5.13	109.63	31.85	0.49
three	3905	779.67	86.21	91.24	89.92	91.87	0.008753	6.35	122.78	32.99	0.58
three	3905	902.39	86.21	91.44	90.23	92.20	0.010137	6.98	129.26	33.57	0.63
three	3895	392.40	86.03	90.30	88.63	90.55	0.004258	4.00	98.08	31.04	0.40
three	3895	430.63	86.03	90.46	88.74	90.73	0.004416	4.17	103.28	31.51	0.41
three	3895	537.34	86.03	90.77	89.08	91.12	0.005279	4.75	113.22	32.38	0.45
three	3895	552.66	86.03	90.81	89.13	91.18	0.005404	4.83	114.52	32.49	0.45
three	3895	754.44	86.03	91.23	89.70	91.77	0.007286	5.88	128.25	33.66	0.53
three	3895	868.73	86.03	91.43	89.99	92.07	0.008337	6.43	135.07	34.23	0.57
three	3885	392.40	85.90	90.27	88.49	90.50	0.003849	3.84	102.11	31.78	0.38
three	3885	428.91	85.90	90.44	88.62	90.68	0.003966	3.99	107.47	32.26	0.39
three	3885	527.89	85.90	90.75	88.93	91.06	0.004618	4.48	117.75	33.14	0.42
three	3885	542.24	85.90	90.79	88.97	91.11	0.004717	4.55	119.09	33.25	0.42
three	3885	727.24	85.90	91.22	89.49	91.68	0.006125	5.45	133.44	34.44	0.49
three	3885	832.68	85.90	91.42	89.77	91.97	0.006913	5.92	140.64	35.03	0.52
three	3880	392.40	85.90	90.14	89.10	90.46	0.007569	4.55	86.25	35.72	0.52
three	3880	428.31	85.90	90.32	89.22	90.65	0.007392	4.63	92.60	36.71	0.51
three	3880	523.59	85.90	90.64	89.51	91.03	0.007858	5.00	104.64	38.52	0.54
three	3880	537.45	85.90	90.68	89.55	91.08	0.007939	5.06	106.23	38.76	0.54
three	3880	713.88	85.90	91.12	90.02	91.63	0.009159	5.77	123.83	41.25	0.59
three	3880	814.64	85.90	91.34	90.25	91.92	0.009748	6.12	133.21	42.52	0.61
three	3875	392.40	85.86	90.17	88.45	90.41	0.004122	3.95	99.36	31.21	0.39
three	3875	427.88	85.86	90.34	88.57	90.60	0.004209	4.09	104.74	31.69	0.40
three	3875	519.65	85.86	90.66	88.87	90.97	0.004758	4.52	114.89	32.59	0.42
three	3875	533.01	85.86	90.70	88.91	91.02	0.004844	4.59	116.21	32.70	0.43
three	3875	700.88	85.86	91.13	89.41	91.58	0.005998	5.37	130.62	33.92	0.48
three	3875	796.90	85.86	91.35	89.65	91.86	0.006625	5.77	138.05	34.54	0.51
three	3865	392.40	85.77	90.11	88.42	90.36	0.004352	4.05	96.96	30.49	0.40
three	3865	426.66	85.77	90.28	88.54	90.55	0.004420	4.17	102.22	30.98	0.40
three	3865	510.98	85.77	90.60	88.82	90.92	0.004847	4.55	112.25	31.88	0.43
three	3865	523.42	85.77	90.64	88.86	90.97	0.004939	4.62	113.41	31.99	0.43
three	3865	673.86	85.77	91.08	89.32	91.51	0.005825	5.27	127.80	33.24	0.47
three	3865	760.16	85.77	91.31	89.54	91.80	0.006263	5.61	135.62	33.90	0.49
three	3855	392.40	85.68	90.04	88.40	90.31	0.004665	4.17	94.12	29.74	0.41
three	3855	425.56	85.68	90.21	88.51	90.50	0.004708	4.29	99.26	30.21	0.42
three	3855	502.46	85.68	90.54	88.77	90.86	0.004985	4.60	109.14	30.99	0.43
three	3855	514.00	85.68	90.57	88.81	90.91	0.005051	4.66	110.36	31.08	0.44
three	3855	646.62	85.68	91.02	89.23	91.44	0.005687	5.19	124.60	32.42	0.47
three	3855	722.55	85.68	91.27	89.44	91.73	0.006001	5.44	132.82	33.47	0.48
three	3845	392.40	85.59	89.96	88.39	90.25	0.005095	4.34	90.51	28.59	0.43
three	3845	424.73	85.59	90.13	88.50	90.44	0.005169	4.45	95.51	29.32	0.43
three	3845	494.40	85.59	90.46	88.74	90.80	0.005401	4.70	105.25	30.69	0.45
three	3845	504.89	85.59	90.51	88.78	90.85	0.005431	4.73	106.70	30.89	0.45

HEC-RAS Plan: Plan 37 River: upper penitencia Reach: three (Continued)

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
three	3845	619.25	85.59	90.97	89.14	91.37	0.005769	5.10	121.54	32.85	0.47
three	3845	683.90	85.59	91.25	89.32	91.67	0.005795	5.23	130.71	34.00	0.47
three	3835	392.40	85.50	89.88	88.38	90.20	0.005900	4.51	87.01	28.91	0.46
three	3835	424.13	85.50	90.06	88.49	90.39	0.005908	4.61	92.10	29.65	0.46
three	3835	486.81	85.50	90.38	88.71	90.74	0.005899	4.77	102.01	31.02	0.46
three	3835	496.13	85.50	90.43	88.76	90.79	0.005895	4.79	103.48	31.22	0.46
three	3835	591.49	85.50	90.92	89.07	91.30	0.005711	4.96	119.24	33.28	0.46
three	3835	643.72	85.50	91.22	89.24	91.60	0.005426	4.98	129.39	34.54	0.45
three	3825	392.40	85.41	89.80	88.43	90.14	0.006676	4.66	84.26	29.26	0.48
three	3825	424.10	85.41	89.98	88.55	90.33	0.006620	4.74	89.44	30.00	0.48
three	3825	486.44	85.41	90.31	88.78	90.68	0.006496	4.89	99.53	31.39	0.48
three	3825	495.71	85.41	90.35	88.81	90.73	0.006476	4.91	101.03	31.59	0.48
three	3825	590.10	85.41	90.85	89.13	91.24	0.006126	5.04	117.15	33.67	0.48
three	3825	641.67	85.41	91.15	89.30	91.55	0.005738	5.03	127.61	34.95	0.46
three	3815	392.40	85.33	89.72	88.42	90.08	0.007139	4.76	82.36	29.06	0.50
three	3815	424.10	85.33	89.90	88.55	90.26	0.007049	4.84	87.54	29.79	0.50
three	3815	486.44	85.33	90.23	88.77	90.62	0.006869	4.98	97.63	31.16	0.50
three	3815	495.71	85.33	90.28	88.81	90.67	0.006842	5.00	99.12	31.36	0.50
three	3815	590.10	85.33	90.78	89.12	91.19	0.006406	5.12	115.30	33.44	0.49
three	3815	641.67	85.33	91.09	89.28	91.49	0.005959	5.10	125.89	34.73	0.47
three	3805	392.40	85.30	89.66	88.31	90.00	0.006840	4.70	83.45	29.26	0.49
three	3805	424.10	85.30	89.83	88.44	90.19	0.006755	4.78	88.68	29.99	0.49
three	3805	486.44	85.30	90.17	88.67	90.54	0.006583	4.92	98.89	31.35	0.49
three	3805	495.71	85.30	90.21	88.70	90.59	0.006558	4.94	100.40	31.55	0.49
three	3805	590.10	85.30	90.72	89.02	91.11	0.006135	5.05	116.82	33.62	0.48
three	3805	641.67	85.30	91.03	89.18	91.43	0.005696	5.03	127.63	34.92	0.46
three	3795	392.40	85.27	89.58	88.24	89.93	0.007000	4.76	82.44	28.85	0.50
three	3795	424.10	85.27	89.76	88.37	90.12	0.006904	4.84	87.62	29.55	0.50
three	3795	486.44	85.27	90.09	88.61	90.48	0.006715	4.98	97.71	30.87	0.49
three	3795	495.71	85.27	90.14	88.64	90.53	0.006688	5.00	99.20	31.06	0.49
three	3795	590.10	85.27	90.65	88.96	91.05	0.006233	5.11	115.49	33.07	0.48
three	3795	641.67	85.27	90.97	89.12	91.37	0.005766	5.08	126.30	34.33	0.47
three	3791	392.40	85.30	89.57	88.37	89.90	0.006526	4.57	85.82	30.81	0.48
three	3791	424.10	85.30	89.75	88.48	90.09	0.006340	4.64	91.39	31.30	0.48
three	3791	486.44	85.30	90.09	88.68	90.44	0.006039	4.77	102.08	32.22	0.47
three	3791	495.71	85.30	90.14	88.70	90.49	0.006000	4.78	103.64	32.35	0.47
three	3791	590.10	85.30	90.65	88.96	91.02	0.005499	4.90	120.48	33.75	0.46
three	3791	641.67	85.30	90.97	89.11	91.34	0.005063	4.88	131.43	34.62	0.44
three	3785	392.40	85.25	89.41		89.84	0.008753	5.25	74.69	26.60	0.55
three	3785	424.10	85.25	89.59		90.03	0.008649	5.34	79.41	27.32	0.55
three	3785	486.44	85.25	89.92		90.39	0.008417	5.48	88.70	28.68	0.55
three	3785	495.71	85.25	89.97		90.44	0.008381	5.50	90.09	28.88	0.55
three	3785	590.10	85.25	90.48		90.97	0.007735	5.59	105.50	30.98	0.53
three	3785	641.67	85.25	90.82		91.29	0.007065	5.53	116.05	32.35	0.51
three	3775	392.40	85.05	89.36		89.76	0.007621	5.02	78.15	26.70	0.52
three	3775	424.10	85.05	89.54		89.95	0.007580	5.12	82.88	27.36	0.52
three	3775	486.44	85.05	89.87		90.30	0.007462	5.28	92.16	28.63	0.52
three	3775	495.71	85.05	89.92		90.36	0.007442	5.30	93.54	28.81	0.52
three	3775	590.10	85.05	90.44		90.89	0.006966	5.42	108.93	30.78	0.51
three	3775	641.67	85.05	90.78		91.22	0.006388	5.36	119.62	32.08	0.49
three	3765	392.40	84.85	89.33		89.67	0.006586	4.72	83.07	28.11	0.48
three	3765	424.10	84.85	89.50		89.86	0.006558	4.82	88.02	28.77	0.49
three	3765	486.44	84.85	89.83		90.22	0.006471	4.98	97.73	30.03	0.49
three	3765	495.71	84.85	89.88		90.27	0.006456	5.00	99.17	30.22	0.49
three	3765	590.10	84.85	90.40		90.80	0.006057	5.12	115.29	32.19	0.48
three	3765	641.67	84.85	90.75		91.14	0.005471	5.06	126.79	33.22	0.46
three	3755	392.40	84.65	89.29		89.61	0.005837	4.52	86.79	28.65	0.46
three	3755	424.10	84.65	89.46		89.79	0.005812	4.62	91.79	29.18	0.46
three	3755	486.44	84.65	89.79		90.15	0.005740	4.79	101.55	30.20	0.46
three	3755	495.71	84.65	89.84		90.20	0.005728	4.81	102.99	30.35	0.46
three	3755	590.10	84.65	90.35		90.74	0.005392	4.96	119.09	31.94	0.45
three	3755	641.67	84.65	90.71		91.08	0.004922	4.91	130.57	33.00	0.44

HEC-RAS Plan: Plan 37 River: upper penitencia Reach: three (Continued)

Reach	River Sta	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
three	3745	392.40	84.44	89.25		89.55	0.005211	4.42	88.78	27.58	0.43
three	3745	424.10	84.44	89.42		89.74	0.005253	4.53	93.58	28.11	0.44
three	3745	486.44	84.44	89.75		90.10	0.005293	4.73	102.94	29.12	0.44
three	3745	495.71	84.44	89.80		90.15	0.005296	4.75	104.33	29.27	0.44
three	3745	590.10	84.44	90.31		90.69	0.005102	4.92	119.87	30.86	0.44
three	3745	641.67	84.44	90.67		91.04	0.004714	4.90	131.05	31.96	0.43
three	3735	392.40	84.27	89.22		89.50	0.004497	4.19	93.64	28.29	0.41
three	3735	424.10	84.27	89.40		89.68	0.004560	4.30	98.55	28.87	0.41
three	3735	486.44	84.27	89.72		90.04	0.004640	4.50	108.17	29.98	0.42
three	3735	495.71	84.27	89.77		90.09	0.004648	4.52	109.59	30.14	0.42
three	3735	590.10	84.27	90.29		90.63	0.004525	4.70	125.65	31.90	0.42
three	3735	641.67	84.27	90.65		90.99	0.004198	4.67	137.28	33.11	0.40
three	3725	392.40	84.37	89.20		89.45	0.003965	4.00	98.13	28.76	0.38
three	3725	424.10	84.37	89.37		89.63	0.004037	4.11	103.11	29.32	0.39
three	3725	486.44	84.37	89.70		89.99	0.004135	4.31	112.85	30.38	0.39
three	3725	495.71	84.37	89.74		90.04	0.004146	4.34	114.29	30.53	0.40
three	3725	590.10	84.37	90.26		90.58	0.004071	4.52	130.56	32.22	0.40
three	3725	641.67	84.37	90.62		90.94	0.003794	4.51	142.37	33.39	0.38
three	3705	392.40	84.37	89.05		89.35	0.005122	4.41	89.00	27.26	0.43
three	3705	424.10	84.37	89.22		89.54	0.005223	4.53	93.61	27.90	0.44
three	3705	486.44	84.37	89.54		89.89	0.005349	4.73	102.74	29.15	0.44
three	3705	495.71	84.37	89.58		89.94	0.005361	4.76	104.11	29.33	0.45
three	3705	590.10	84.37	90.11		90.48	0.005192	4.92	119.95	31.35	0.44
three	3705	641.67	84.37	90.48		90.85	0.004751	4.86	131.97	32.81	0.43
three	3695	392.40	84.21	89.05	87.07	89.29	0.003962	3.95	99.31	30.06	0.38
three	3695	424.10	84.21	89.22	87.20	89.47	0.004034	4.06	104.41	30.71	0.39
three	3695	486.44	84.21	89.54	87.44	89.82	0.004125	4.25	114.49	31.93	0.40
three	3695	495.71	84.21	89.59	87.47	89.87	0.004134	4.27	115.99	32.11	0.40
three	3695	590.10	84.21	90.11	87.81	90.41	0.004010	4.43	133.28	34.10	0.39
three	3695	641.67	84.21	90.49	87.98	90.78	0.003673	4.38	146.40	35.54	0.38
three	3663	392.40	84.40	88.34	87.94	89.01	0.018044	6.53	60.07	27.48	0.78
three	3663	424.10	84.40	88.56	88.05	89.20	0.016215	6.42	66.04	28.58	0.74
three	3663	486.44	84.40	88.95	88.27	89.56	0.013610	6.26	77.74	30.62	0.69
three	3663	495.71	84.40	89.01	88.30	89.61	0.013301	6.24	79.48	30.91	0.69
three	3663	590.10	84.40	89.66	88.62	90.20	0.009822	5.85	100.83	34.29	0.60
three	3663	641.67	84.40	90.14	88.77	90.60	0.007601	5.45	117.81	36.75	0.54
three	3631	392.40	84.30	88.44	86.63	88.66	0.003532	3.76	104.38	29.37	0.35
three	3631	424.10	84.30	88.64	86.73	88.87	0.003494	3.85	110.24	29.39	0.35
three	3631	486.44	84.30	89.01	86.91	89.26	0.003452	4.01	121.17	29.42	0.35
three	3631	495.71	84.30	89.06	86.93	89.31	0.003448	4.04	122.74	29.43	0.35
three	3631	590.10	84.30	89.68	87.19	89.95	0.003228	4.19	140.95	29.48	0.34
three	3631	641.67	84.30	90.13	87.32	90.40	0.002914	4.16	154.38	29.53	0.32
three	3616	Bridge									
three	3602	392.40	83.90	88.13	86.56	88.50	0.006630	4.88	80.41	21.71	0.45
three	3602	424.10	83.90	88.31	86.68	88.71	0.006687	5.02	84.48	21.73	0.45
three	3602	486.44	83.90	88.66	86.90	89.10	0.006829	5.29	92.04	21.77	0.45
three	3602	495.71	83.90	88.71	86.93	89.15	0.006853	5.32	93.11	21.77	0.45
three	3602	590.10	83.90	89.19	87.26	89.69	0.007137	5.70	103.44	21.82	0.46
three	3602	641.67	83.90	89.43	87.42	89.97	0.007307	5.90	108.70	21.84	0.47
three	3548	392.40	83.40	87.80	86.27	88.15	0.006173	4.78	82.03	25.38	0.47
three	3548	424.10	83.40	87.99	86.40	88.36	0.006126	4.88	86.92	25.89	0.47
three	3548	486.44	83.40	88.34	86.64	88.74	0.006053	5.05	96.28	26.85	0.47
three	3548	495.71	83.40	88.39	86.68	88.79	0.006041	5.08	97.65	26.99	0.47
three	3548	590.10	83.40	88.88	87.01	89.32	0.005968	5.31	111.16	28.30	0.47
three	3548	641.67	83.40	89.13	87.18	89.59	0.005938	5.42	118.30	28.97	0.47
three	3358	392.40	81.00	86.62	84.94	86.99	0.006105	4.86	80.79	23.73	0.46
three	3358	424.10	81.00	86.81	85.09	87.19	0.006153	4.97	85.26	24.26	0.47
three	3358	486.44	81.00	87.16	85.35	87.57	0.006229	5.18	93.83	25.23	0.47
three	3358	495.71	81.00	87.21	85.39	87.63	0.006231	5.21	95.12	25.38	0.47
three	3358	590.10	81.00	87.68	85.76	88.15	0.006321	5.49	107.53	26.72	0.48
three	3358	641.67	81.00	87.93	85.94	88.42	0.006355	5.62	114.14	27.41	0.49

HEC-RAS Plan: Plan 37 River: upper penitencia Reach: three (Continued)

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
three	3157	392.40	80.60	85.56	83.80	85.87	0.004953	4.42	88.71	26.12	0.42
three	3157	424.10	80.60	85.74	83.94	86.06	0.005014	4.54	93.34	26.57	0.43
three	3157	486.44	80.60	86.07	84.17	86.42	0.005105	4.76	102.26	27.43	0.43
three	3157	495.71	80.60	86.12	84.21	86.48	0.005099	4.78	103.69	27.56	0.43
three	3157	590.10	80.60	86.58	84.54	86.98	0.005215	5.06	116.55	28.74	0.44
three	3157	641.67	80.60	86.82	84.71	87.24	0.005254	5.20	123.46	29.36	0.45
three	2957	392.40	79.50	83.88	83.00	84.42	0.011065	5.89	66.63	23.70	0.62
three	2957	424.10	79.50	84.07	83.13	84.62	0.010761	5.97	71.08	24.20	0.61
three	2957	486.44	79.50	84.42	83.37	84.99	0.010278	6.10	79.74	25.25	0.60
three	2957	495.71	79.50	84.47	83.40	85.05	0.010212	6.12	81.02	25.40	0.60
three	2957	590.10	79.50	84.96	83.73	85.57	0.009601	6.28	93.96	26.88	0.59
three	2957	641.67	79.50	85.22	83.90	85.85	0.009307	6.35	100.99	27.66	0.59
three	2680	392.40	77.10	82.68	80.46	82.88	0.002994	3.63	108.25	29.72	0.33
three	2680	424.10	77.10	82.88	80.58	83.10	0.002989	3.71	114.37	30.22	0.34
three	2680	486.44	77.10	83.26	80.79	83.49	0.002987	3.86	125.98	31.15	0.34
three	2680	495.71	77.10	83.32	80.82	83.55	0.002986	3.88	127.69	31.28	0.34
three	2680	590.10	77.10	83.85	81.13	84.11	0.002964	4.07	144.83	32.60	0.34
three	2680	641.67	77.10	84.13	81.28	84.40	0.002948	4.17	154.04	33.29	0.34
three	2567	392.40	76.30	82.31	80.00	82.53	0.003214	3.74	104.83	27.67	0.34
three	2567	424.10	76.30	82.52	80.14	82.74	0.003221	3.84	110.45	27.97	0.34
three	2567	486.44	76.30	82.89	80.39	83.14	0.003251	4.02	120.97	28.53	0.34
three	2567	495.71	76.30	82.94	80.42	83.20	0.003254	4.05	122.51	28.61	0.34
three	2567	590.10	76.30	83.47	80.78	83.76	0.003277	4.28	137.87	29.40	0.35
three	2567	641.67	76.30	83.75	80.95	84.05	0.003283	4.39	146.05	29.81	0.35
three	2477	392.40	76.80	81.83	80.05	82.16	0.005243	4.58	85.64	22.87	0.42
three	2477	424.10	76.80	82.02	80.17	82.37	0.005296	4.71	90.02	23.04	0.42
three	2477	486.44	76.80	82.37	80.40	82.75	0.005434	4.96	98.08	23.37	0.43
three	2477	495.71	76.80	82.42	80.43	82.81	0.005452	4.99	99.26	23.42	0.43
three	2477	590.10	76.80	82.92	80.75	83.36	0.005603	5.32	111.01	23.88	0.43
three	2477	641.67	76.80	83.18	80.92	83.64	0.005668	5.47	117.24	24.13	0.44
three	2350	392.40	76.00	80.24		81.01	0.016950	7.06	55.58	19.16	0.73
three	2350	424.10	76.00	80.40		81.21	0.016869	7.23	58.67	19.27	0.73
three	2350	486.44	76.00	80.70		81.59	0.016752	7.54	64.55	19.47	0.73
three	2350	495.71	76.00	80.75		81.64	0.016739	7.58	65.40	19.50	0.73
three	2350	590.10	76.00	81.18		82.17	0.016631	7.99	73.87	19.79	0.73
three	2350	641.67	76.00	81.40		82.45	0.016592	8.19	78.34	19.94	0.73
three	2298	392.40	75.30	80.04	78.61	80.37	0.006381	4.63	84.73	25.24	0.45
three	2298	424.10	75.30	80.21	78.71	80.56	0.006385	4.76	89.16	25.29	0.45
three	2298	486.44	75.30	80.54	78.90	80.93	0.006412	4.99	97.50	25.40	0.45
three	2298	495.71	75.30	80.59	78.93	80.98	0.006417	5.02	98.70	25.41	0.45
three	2298	590.10	75.30	81.05	79.22	81.49	0.006483	5.34	110.51	25.56	0.45
three	2298	641.67	75.30	81.29	79.37	81.76	0.006525	5.50	116.66	25.64	0.45
three	2272	Bridge									
three	2257	392.40	75.60	79.71	78.42	80.08	0.007324	4.93	79.52	24.44	0.48
three	2257	424.10	75.60	79.88	78.53	80.28	0.007304	5.06	83.77	24.48	0.48
three	2257	486.44	75.60	80.20	78.74	80.64	0.007311	5.30	91.72	24.55	0.48
three	2257	495.71	75.60	80.25	78.77	80.69	0.007316	5.34	92.87	24.56	0.48
three	2257	590.10	75.60	80.70	79.06	81.20	0.007387	5.67	104.02	24.65	0.49
three	2257	641.67	75.60	80.94	79.21	81.47	0.007440	5.84	109.80	24.70	0.49
three	2210	392.40	75.30	79.45		79.76	0.005630	4.48	87.61	28.59	0.45
three	2210	424.10	75.30	79.63		79.96	0.005594	4.57	92.83	29.21	0.45
three	2210	486.44	75.30	79.97		80.32	0.005525	4.73	102.87	30.37	0.45
three	2210	495.71	75.30	80.02		80.37	0.005515	4.75	104.34	30.53	0.45
three	2210	590.10	75.30	80.49		80.87	0.005399	4.95	119.21	32.16	0.45
three	2210	641.67	75.30	80.74		81.13	0.005330	5.04	127.25	33.01	0.45
three	2035	392.40	74.00	79.06		79.19	0.001811	2.90	135.37	36.44	0.27
three	2035	424.10	74.00	79.24		79.38	0.001848	2.99	141.90	36.99	0.27
three	2035	486.44	74.00	79.57		79.73	0.001911	3.15	154.42	38.02	0.28
three	2035	495.71	74.00	79.62		79.78	0.001919	3.17	156.25	38.17	0.28
three	2035	590.10	74.00	80.10		80.27	0.001982	3.38	174.70	39.63	0.28
three	2035	641.67	74.00	80.34		80.53	0.002004	3.48	184.63	40.39	0.29

HEC-RAS Plan: Plan 37 River: upper penitencia Reach: three (Continued)

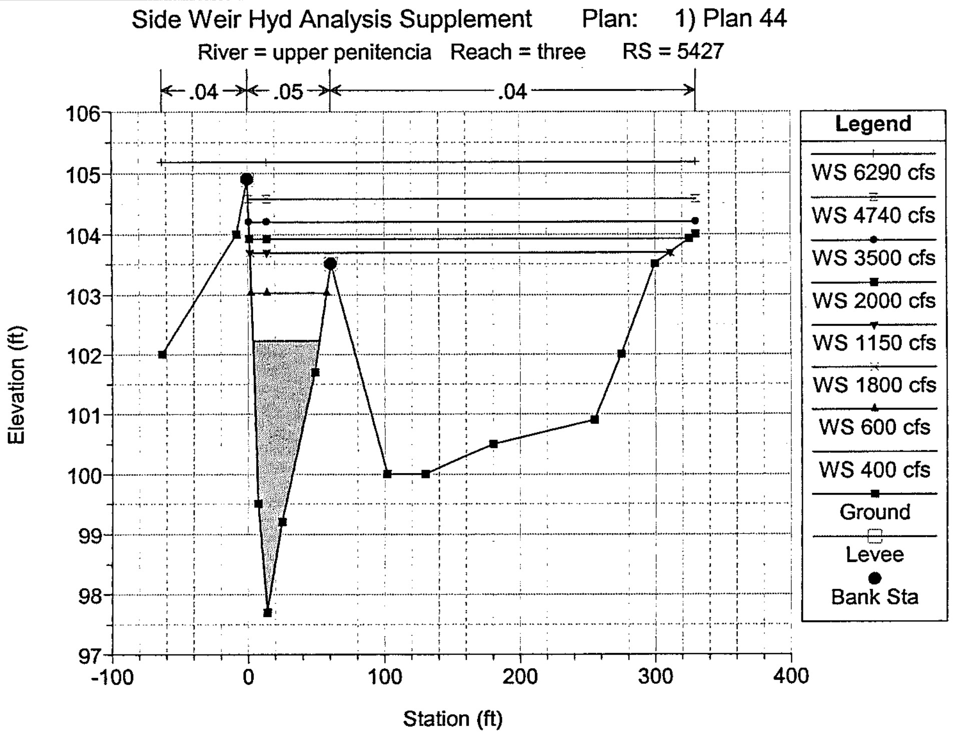
Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
three	2012	392.40	74.60	78.84	77.46	79.11	0.005688	4.18	93.84	33.59	0.44
three	2012	424.10	74.60	79.02	77.56	79.30	0.005573	4.25	99.85	34.26	0.44
three	2012	486.44	74.60	79.35	77.77	79.64	0.005376	4.36	111.47	35.52	0.43
three	2012	495.71	74.60	79.40	77.80	79.69	0.005348	4.38	113.18	35.70	0.43
three	2012	590.10	74.60	79.87	78.07	80.19	0.005076	4.52	130.61	37.50	0.43
three	2012	641.67	74.60	80.12	78.21	80.45	0.004935	4.58	140.12	38.44	0.42
three	2000	Bridge									
three	1988	392.40	74.40	78.65	77.07	78.89	0.004576	3.93	99.75	34.84	0.41
three	1988	424.10	74.40	78.83	77.18	79.08	0.004507	4.00	106.02	35.67	0.41
three	1988	486.44	74.40	79.16	77.38	79.43	0.004326	4.12	118.17	36.65	0.40
three	1988	495.71	74.40	79.21	77.41	79.48	0.004300	4.13	119.95	36.77	0.40
three	1988	590.10	74.40	79.69	77.71	79.97	0.004063	4.28	137.86	37.94	0.40
three	1988	641.67	74.40	79.94	77.86	80.24	0.003950	4.35	147.51	38.56	0.39
three	1966	392.40	74.00	78.40		78.75	0.006844	4.78	82.04	28.40	0.50
three	1966	424.10	74.00	78.57		78.94	0.006773	4.87	87.02	29.00	0.50
three	1966	486.44	74.00	78.90		79.29	0.006609	5.03	96.80	30.16	0.49
three	1966	495.71	74.00	78.95		79.35	0.006583	5.05	98.25	30.33	0.49
three	1966	590.10	74.00	79.43		79.85	0.006300	5.22	113.10	32.00	0.49
three	1966	641.67	74.00	79.68		80.11	0.006134	5.29	121.29	32.88	0.49
three	1879	392.40	73.80	77.85		78.18	0.006209	4.59	85.53	29.06	0.47
three	1879	424.10	73.80	78.04		78.37	0.006064	4.66	90.95	29.54	0.47
three	1879	486.44	73.80	78.39		78.75	0.005799	4.79	101.53	30.46	0.46
three	1879	495.71	73.80	78.44		78.80	0.005762	4.81	103.10	30.59	0.46
three	1879	590.10	73.80	78.95		79.33	0.005410	4.96	118.97	31.91	0.45
three	1879	641.67	73.80	79.22		79.61	0.005233	5.03	127.63	32.61	0.45
three	1795	392.40	72.30	77.43		77.71	0.004774	4.20	93.32	29.22	0.41
three	1795	424.10	72.30	77.63		77.91	0.004718	4.28	99.02	29.83	0.41
three	1795	486.44	72.30	77.99		78.30	0.004593	4.41	110.22	30.99	0.41
three	1795	495.71	72.30	78.05		78.35	0.004573	4.43	111.88	31.15	0.41
three	1795	590.10	72.30	78.58		78.91	0.004363	4.58	128.92	32.83	0.41
three	1795	641.67	72.30	78.86		79.20	0.004244	4.64	138.29	33.71	0.40
three	1700	392.40	72.00	76.70	75.43	77.12	0.008007	5.16	76.01	25.89	0.53
three	1700	424.10	72.00	76.91	75.57	77.33	0.007732	5.20	81.52	26.70	0.52
three	1700	486.44	72.00	77.32	75.82	77.75	0.007191	5.25	92.64	28.26	0.51
three	1700	495.71	72.00	77.38	75.85	77.81	0.007112	5.26	94.33	28.49	0.51
three	1700	590.10	72.00	77.97	76.20	78.40	0.006365	5.28	111.80	30.76	0.49
three	1700	641.67	72.00	78.28	76.37	78.71	0.006002	5.28	121.59	31.97	0.48
three	1572	392.40	71.30	76.21		76.43	0.003420	3.74	104.95	30.70	0.36
three	1572	424.10	71.30	76.44		76.66	0.003313	3.78	112.12	31.39	0.35
three	1572	486.44	71.30	76.88		77.11	0.003114	3.85	126.29	32.71	0.35
three	1572	495.71	71.30	76.95		77.18	0.003087	3.86	128.41	32.91	0.34
three	1572	590.10	71.30	77.58		77.82	0.002834	3.94	149.91	34.80	0.33
three	1572	641.67	71.30	77.92		78.17	0.002706	3.96	161.86	35.81	0.33
three	1472	392.40	71.00	75.74	73.99	76.02	0.004640	4.26	92.16	27.69	0.41
three	1472	424.10	71.00	75.99	74.11	76.28	0.004405	4.28	99.15	28.36	0.40
three	1472	486.44	71.00	76.47	74.33	76.75	0.004016	4.31	112.92	29.64	0.39
three	1472	495.71	71.00	76.53	74.36	76.82	0.003966	4.31	114.96	29.83	0.39
three	1472	590.10	71.00	77.21	74.67	77.50	0.003539	4.35	135.63	31.64	0.37
three	1472	641.67	71.00	77.56	74.84	77.86	0.003340	4.36	147.08	32.60	0.36
three	1391	392.40	69.90	75.69	72.35	75.79	0.001246	2.55	153.86	37.77	0.22
three	1391	424.10	69.90	75.95	72.47	76.05	0.001230	2.59	163.56	38.74	0.22
three	1391	486.44	69.90	76.43	72.69	76.54	0.001195	2.66	182.68	40.59	0.22
three	1391	495.71	69.90	76.50	72.72	76.61	0.001190	2.67	185.52	40.86	0.22
three	1391	590.10	69.90	77.18	73.02	77.30	0.001137	2.75	214.28	43.46	0.22
three	1391	641.67	69.90	77.54	73.17	77.66	0.001105	2.79	230.23	44.85	0.22
three	1369	392.40	69.90	75.49	72.81	75.74	0.003443	4.00	98.14	20.57	0.32
three	1369	424.10	69.90	75.73	72.94	75.99	0.003490	4.11	103.12	20.69	0.32
three	1369	486.44	69.90	76.19	73.18	76.48	0.003568	4.32	112.69	20.93	0.33
three	1369	495.71	69.90	76.26	73.21	76.55	0.003578	4.35	114.08	20.96	0.33
three	1369	590.10	69.90	76.90	73.56	77.24	0.003684	4.62	127.78	21.30	0.33
three	1369	641.67	69.90	77.25	73.73	77.60	0.003724	4.75	135.14	21.47	0.33

HEC-RAS Plan: Plan 37 River: upper penitencia Reach: three (Continued)

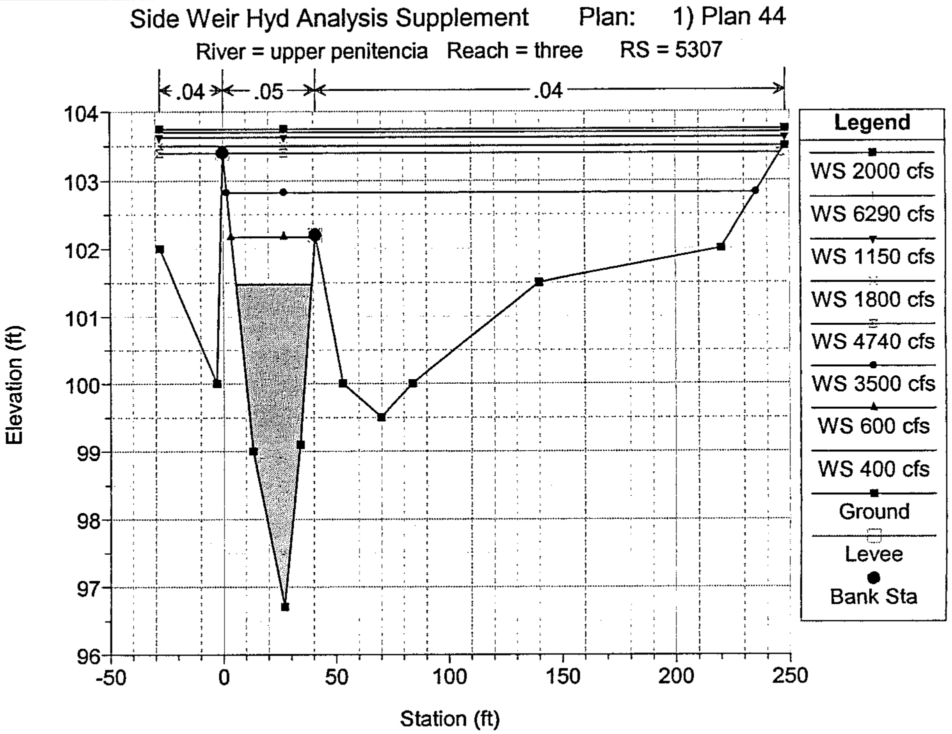
Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
three	1338	Bridge									
three	1310	392.40	69.80	74.32		74.86	0.010477	5.86	66.93	18.57	0.54
three	1310	424.10	69.80	74.47		75.04	0.010916	6.09	69.59	18.57	0.55
three	1310	486.44	69.80	74.73		75.39	0.011771	6.53	74.47	18.59	0.58
three	1310	495.71	69.80	74.77		75.44	0.011897	6.59	75.17	18.59	0.58
three	1310	590.10	69.80	75.12		75.93	0.013168	7.21	81.84	18.61	0.61
three	1310	641.67	69.80	75.31		76.19	0.013858	7.53	85.21	18.62	0.62
three	1286	392.40	69.40	74.29		74.62	0.005300	4.55	86.25	25.56	0.44
three	1286	424.10	69.40	74.45		74.79	0.005476	4.71	90.14	25.97	0.45
three	1286	486.44	69.40	74.73		75.11	0.005783	4.99	97.54	26.75	0.46
three	1286	495.71	69.40	74.77		75.16	0.005825	5.03	98.62	26.86	0.46
three	1286	590.10	69.40	75.16		75.61	0.006197	5.39	109.38	27.94	0.48
three	1286	641.67	69.40	75.36		75.84	0.006368	5.58	115.09	28.49	0.49
three	1208	392.40	70.10	73.91		74.18	0.005460	4.23	92.82	33.04	0.44
three	1208	424.10	70.10	74.05		74.35	0.005488	4.34	97.75	33.54	0.45
three	1208	486.44	70.10	74.33		74.65	0.005526	4.54	107.21	34.48	0.45
three	1208	495.71	70.10	74.37		74.70	0.005530	4.56	108.59	34.61	0.45
three	1208	590.10	70.10	74.77		75.13	0.005540	4.82	122.52	35.95	0.46
three	1208	641.67	70.10	74.97		75.35	0.005532	4.94	129.97	36.64	0.46
three	1100	392.40	69.60	73.29		73.57	0.005929	4.27	91.98	34.49	0.46
three	1100	424.10	69.60	73.44		73.73	0.005878	4.36	97.22	34.97	0.46
three	1100	486.44	69.60	73.72		74.04	0.005779	4.53	107.33	35.87	0.46
three	1100	495.71	69.60	73.76		74.09	0.005764	4.56	108.82	36.00	0.46
three	1100	590.10	69.60	74.17		74.52	0.005619	4.77	123.68	37.29	0.46
three	1100	641.67	69.60	74.38		74.75	0.005544	4.87	131.63	37.96	0.46
three	1027	392.40	68.50	72.59		73.01	0.009661	5.20	75.45	30.38	0.58
three	1027	424.10	68.50	72.75		73.18	0.009383	5.28	80.38	30.92	0.58
three	1027	486.44	68.50	73.05		73.51	0.008918	5.41	89.89	31.94	0.57
three	1027	495.71	68.50	73.10		73.55	0.008856	5.43	91.29	32.09	0.57
three	1027	590.10	68.50	73.52		74.01	0.008301	5.60	105.37	33.53	0.56
three	1027	641.67	68.50	73.75		74.25	0.008049	5.68	112.93	34.28	0.55
three	1002	392.40	68.50	72.37	71.31	72.77	0.008871	5.10	76.92	29.39	0.56
three	1002	424.10	68.50	72.53	71.44	72.95	0.008636	5.18	81.87	29.90	0.55
three	1002	486.44	68.50	72.85	71.68	73.29	0.008258	5.32	91.37	30.85	0.55
three	1002	495.71	68.50	72.89	71.71	73.34	0.008208	5.34	92.76	30.99	0.54
three	1002	590.10	68.50	73.33	72.04	73.81	0.007771	5.53	106.69	32.32	0.54
three	1002	641.67	68.50	73.56	72.19	74.05	0.007576	5.62	114.12	33.01	0.53
three	991	Bridge									
three	958	392.40	67.60	72.04		72.40	0.006439	4.77	82.30	26.85	0.48
three	958	424.10	67.60	72.21		72.58	0.006420	4.88	86.88	27.19	0.48
three	958	486.44	67.60	72.53		72.93	0.006403	5.09	95.54	27.83	0.48
three	958	495.71	67.60	72.57		72.98	0.006401	5.12	96.80	27.92	0.48
three	958	590.10	67.60	73.01		73.47	0.006388	5.40	109.27	28.82	0.49
three	958	641.67	67.60	73.24		73.72	0.006385	5.54	115.85	29.28	0.49
three	933	392.40	67.50	71.80		72.21	0.008250	5.13	76.42	27.40	0.54
three	933	424.10	67.50	71.97		72.40	0.008076	5.22	81.28	27.92	0.54
three	933	486.44	67.50	72.30		72.75	0.007809	5.37	90.54	28.90	0.53
three	933	495.71	67.50	72.35		72.80	0.007774	5.39	91.89	29.04	0.53
three	933	590.10	67.50	72.80		73.29	0.007461	5.60	105.45	30.41	0.53
three	933	641.67	67.50	73.04		73.54	0.007318	5.69	112.67	31.11	0.53
three	865	392.40	66.60	71.23		71.64	0.008308	5.14	76.39	27.44	0.54
three	865	424.10	66.60	71.43		71.85	0.008037	5.18	81.82	28.24	0.54
three	865	486.44	66.60	71.78		72.22	0.007642	5.28	92.10	29.70	0.53
three	865	495.71	66.60	71.84		72.27	0.007590	5.30	93.62	29.90	0.53
three	865	590.10	66.60	72.33		72.78	0.007135	5.42	108.81	31.92	0.52
three	865	641.67	66.60	72.58		73.05	0.006928	5.49	116.97	32.95	0.51
three	787	392.40	66.20	70.96		71.18	0.003570	3.77	104.02	31.25	0.36
three	787	424.10	66.20	71.16		71.39	0.003528	3.84	110.42	31.95	0.36
three	787	486.44	66.20	71.53		71.77	0.003488	3.98	122.33	33.23	0.37
three	787	495.71	66.20	71.58		71.83	0.003483	4.00	124.07	33.41	0.37

HEC-RAS Plan: Plan 37 River: upper penitencia Reach: three (Continued)

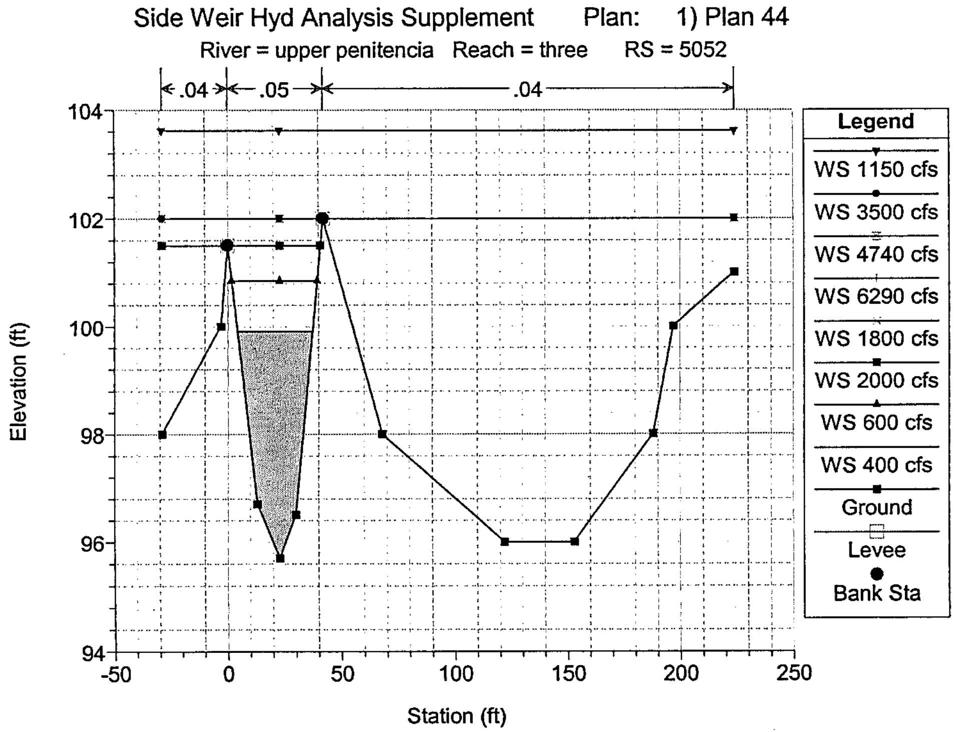
Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
three	787	590.10	66.20	72.08		72.35	0.003441	4.18	141.30	35.16	0.37
three	787	641.67	66.20	72.34		72.62	0.003421	4.27	150.45	36.06	0.37
three	695	392.40	64.80	70.81		70.94	0.001586	2.81	139.66	35.50	0.25
three	695	424.10	64.80	71.02		71.15	0.001606	2.89	146.93	36.16	0.25
three	695	486.44	64.80	71.38		71.52	0.001655	3.03	160.33	37.34	0.26
three	695	495.71	64.80	71.43		71.58	0.001662	3.05	162.28	37.51	0.26
three	695	590.10	64.80	71.94		72.10	0.001724	3.25	181.50	39.13	0.27
three	695	641.67	64.80	72.19		72.37	0.001753	3.35	191.64	39.96	0.27
three	586	392.40	65.00	69.12	69.12	70.37	0.031858	8.98	43.71	17.80	1.01
three	586	424.10	65.00	69.27	69.27	70.56	0.031380	9.12	46.48	18.22	1.01
three	586	486.44	65.00	69.56	69.56	70.93	0.030654	9.40	51.77	19.00	1.00
three	586	495.71	65.00	69.60	69.60	70.98	0.030555	9.43	52.54	19.11	1.00
three	586	590.10	65.00	69.99	69.99	71.48	0.029815	9.81	60.18	20.17	1.00
three	586	641.67	65.00	70.18	70.18	71.73	0.029658	10.01	64.10	20.69	1.00
three	470	392.40	62.70	68.36		68.51	0.002200	3.11	126.03	35.49	0.29
three	470	424.10	62.70	68.69		68.84	0.001996	3.08	137.69	36.53	0.28
three	470	486.44	62.70	69.16		69.31	0.001865	3.13	155.33	38.04	0.27
three	470	495.71	62.70	69.50		69.64	0.001540	2.94	168.50	39.13	0.25
three	470	590.10	62.70	69.99		70.15	0.001602	3.14	188.07	40.71	0.26
three	470	641.67	62.70	70.24		70.40	0.001635	3.24	198.23	41.50	0.26
three	362	392.40	63.30	68.11		68.27	0.002307	3.23	121.44	32.73	0.30
three	362	424.10	63.30	68.46		68.62	0.002078	3.19	133.01	33.67	0.28
three	362	486.44	63.30	68.95		69.11	0.001954	3.25	149.66	34.98	0.28
three	362	495.71	63.30	69.33		69.47	0.001588	3.04	163.21	36.01	0.25
three	362	590.10	63.30	69.81		69.97	0.001690	3.27	180.70	37.30	0.26
three	362	641.67	63.30	70.05		70.22	0.001742	3.38	189.74	37.95	0.27
three	252	392.40	61.80	67.87		68.03	0.002105	3.18	123.26	31.52	0.28
three	252	424.10	61.80	68.25		68.40	0.001899	3.14	135.21	32.59	0.27
three	252	486.44	61.80	68.74		68.90	0.001812	3.21	151.73	34.02	0.27
three	252	495.71	61.80	69.16		69.30	0.001459	2.98	166.34	35.23	0.24
three	252	590.10	61.80	69.63		69.79	0.001589	3.23	182.97	36.56	0.25
three	252	641.67	61.80	69.86		70.04	0.001655	3.35	191.57	37.23	0.26
three	145	392.40	59.80	67.72		67.84	0.001364	2.77	141.66	31.27	0.23
three	145	424.10	59.80	68.11		68.22	0.001275	2.76	153.93	32.52	0.22
three	145	486.44	59.80	68.60		68.73	0.001274	2.85	170.54	34.13	0.22
three	145	495.71	59.80	69.05		69.16	0.001047	2.66	186.16	35.58	0.21
three	145	590.10	59.80	69.50		69.63	0.001184	2.91	202.49	37.03	0.22
three	145	641.67	59.80	69.73		69.87	0.001280	3.04	210.90	38.37	0.23
three	135	392.40	59.00	67.72		67.83	0.001147	2.63	149.40	28.30	0.20
three	135	424.10	59.00	68.10		68.21	0.001103	2.65	160.18	28.81	0.20
three	135	486.44	59.00	68.60		68.72	0.001137	2.78	174.88	29.50	0.20
three	135	495.71	59.00	69.05		69.16	0.000955	2.64	188.11	29.50	0.18
three	135	590.10	59.00	69.49		69.63	0.001117	2.93	201.09	29.50	0.20
three	135	641.67	59.00	69.71		69.86	0.001204	3.09	207.64	29.50	0.21
three	134	392.40	59.00	67.72	63.18	67.83	0.001147	2.63	149.40	28.30	0.20
three	134	424.10	59.00	68.09	63.35	68.20	0.001106	2.65	159.99	28.80	0.20
three	134	486.44	59.00	68.60	63.66	68.72	0.001137	2.78	174.84	29.50	0.20
three	134	495.71	59.00	69.05	63.71	69.16	0.000956	2.64	188.07	29.50	0.18
three	134	590.10	59.00	69.49	64.13	69.62	0.001118	2.94	200.99	29.50	0.20
three	134	641.67	59.00	69.71	64.34	69.86	0.001206	3.09	207.53	29.50	0.21
three	108.5	Culvert									
three	83	392.40	59.10	62.48	62.48	63.58	0.031368	8.39	46.75	21.77	1.01
three	83	424.10	59.10	62.61	62.61	63.75	0.031111	8.57	49.47	22.12	1.01
three	83	486.44	59.10	63.00	62.86	64.08	0.025378	8.33	58.42	23.24	0.93
three	83	495.71	59.10	66.00	62.89	66.19	0.002228	3.52	140.75	31.20	0.29
three	83	590.10	59.10	66.00	63.21	66.27	0.003158	4.19	140.75	31.20	0.35
three	83	641.67	59.10	66.00	63.39	66.32	0.003734	4.56	140.75	31.20	0.38



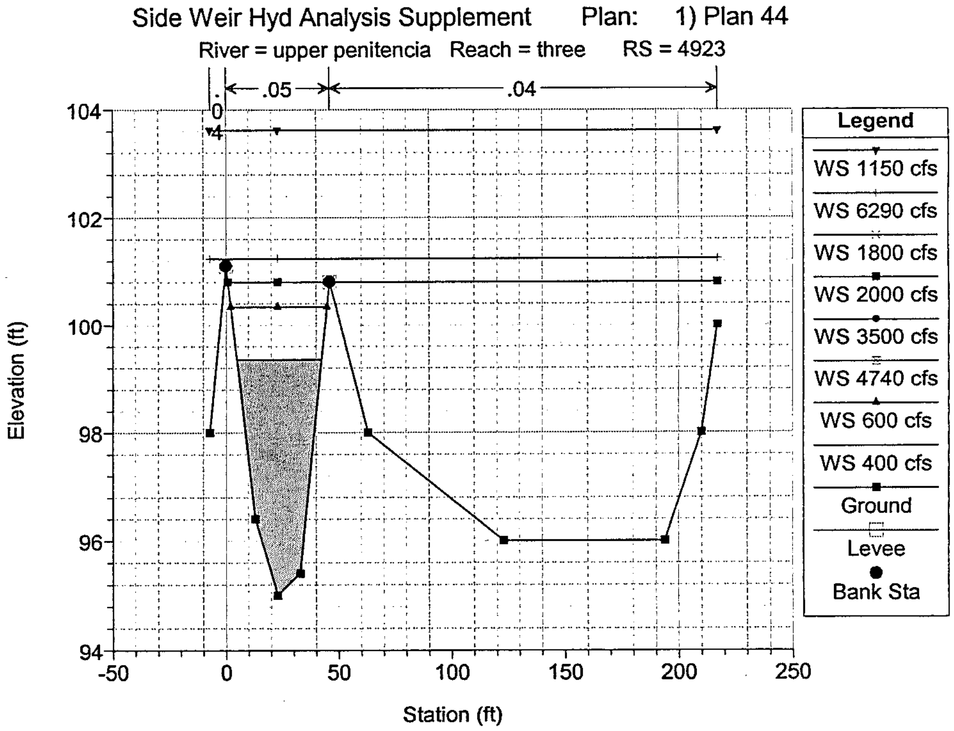
Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 5427
.04
.05
.04
Elevation (ft)
Station (ft)
106
105
104
103
102
101
100
99
98
97
-100
0
100
200
300
400
Legend
WS 6290 cfs
WS 4740 cfs
WS 3500 cfs
WS 2000 cfs
WS 1150 cfs
WS 1800 cfs
WS 600 cfs
WS 400 cfs
Ground
Levee
Bank Sta



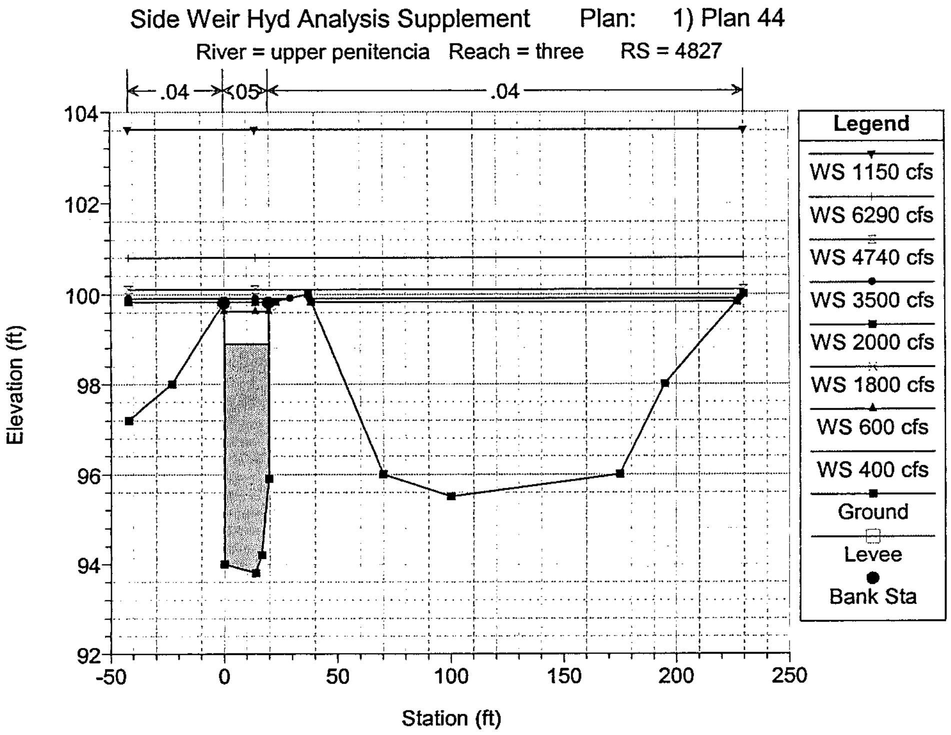
Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 5307
.04
.05
.04
Elevation (ft)
Station (ft)
104
103
102
101
100
99
98
97
96
-50
0
50
100
150
200
250
Legend
WS 2000 cfs
WS 6290 cfs
WS 1150 cfs
WS 1800 cfs
WS 4740 cfs
WS 3500 cfs
WS 600 cfs
WS 400 cfs
Ground
Levee
Bank Sta



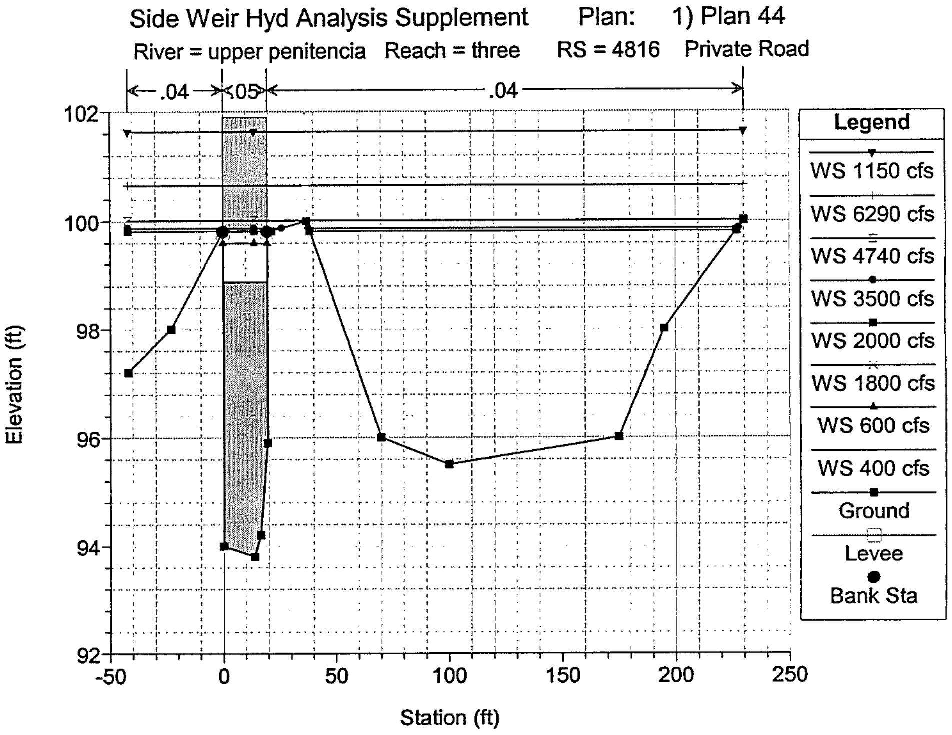
Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 5052
.04
.05
.04
Elevation (ft)
Station (ft)
104
102
100
98
96
94
-50
0
50
100
150
200
250
Legend
WS 1150 cfs
WS 3500 cfs
WS 4740 cfs
WS 6290 cfs
WS 1800 cfs
WS 2000 cfs
WS 600 cfs
WS 400 cfs
Ground
Levee
Bank Sta



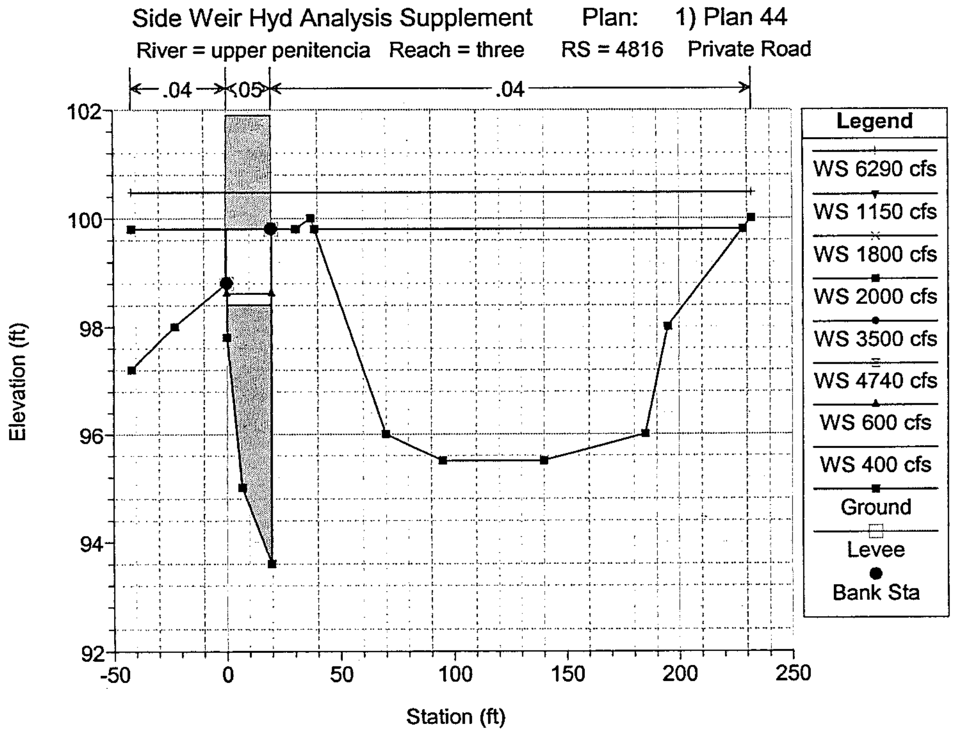
Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 4923
.0
4
.05
.04
Elevation (ft)
Station (ft)
104
102
100
98
96
94
-50
0
50
100
150
200
250
Legend
WS 1150 cfs
WS 6290 cfs
WS 1800 cfs
WS 2000 cfs
WS 3500 cfs
WS 4740 cfs
WS 600 cfs
WS 400 cfs
Ground
Levee
Bank Sta


Side Weir Hyd Analysis Supplement Plan: 1) Plan 44

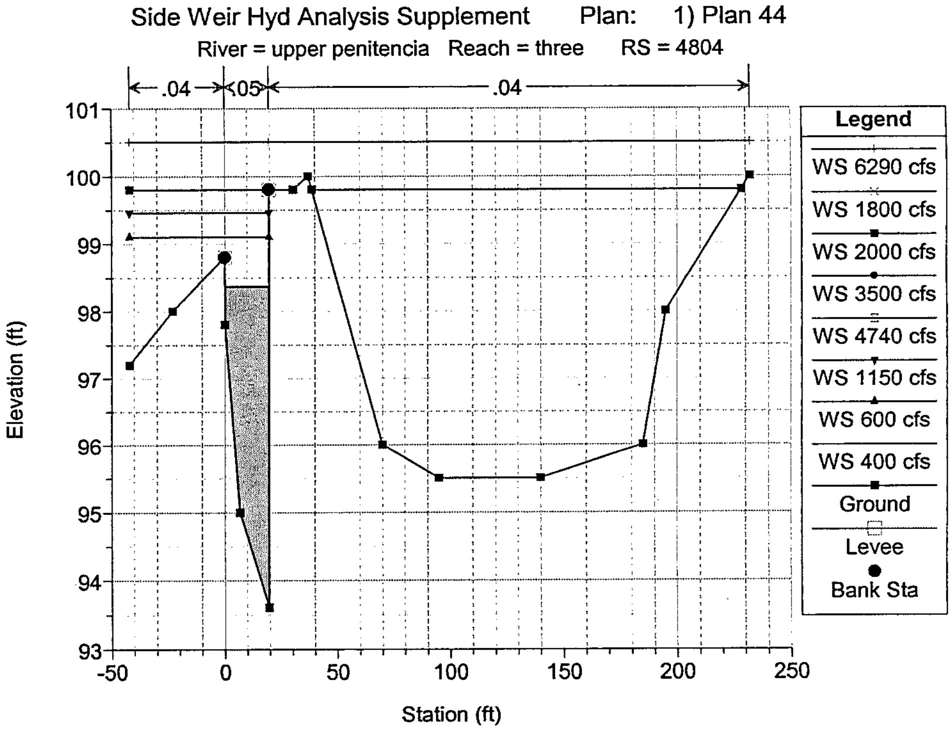
River = upper penitencia Reach = three RS = 4827


Side Weir Hyd Analysis Supplement Plan: 1) Plan 44

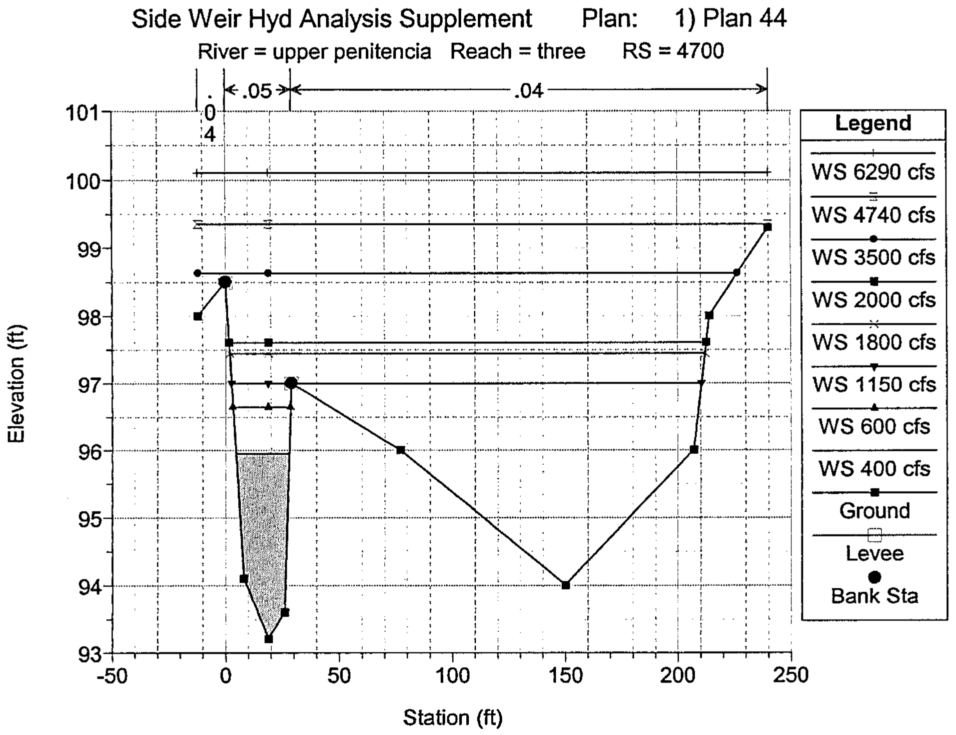
River = upper penitencia Reach = three RS = 4816 Private Road

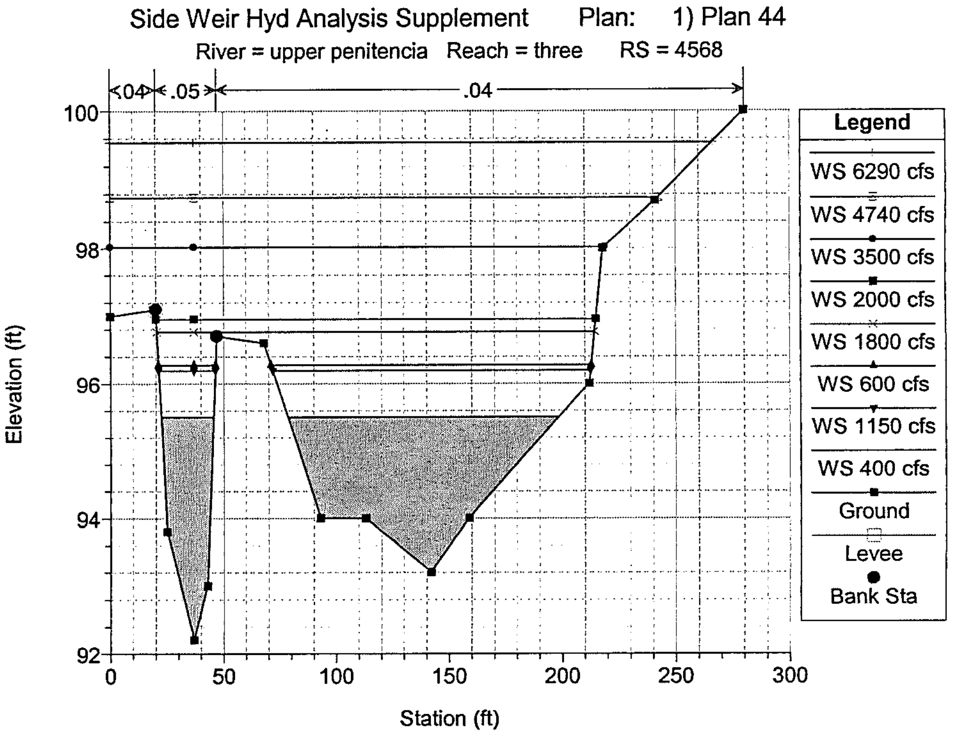

Side Weir Hyd Analysis Supplement Plan: 1) Plan 44

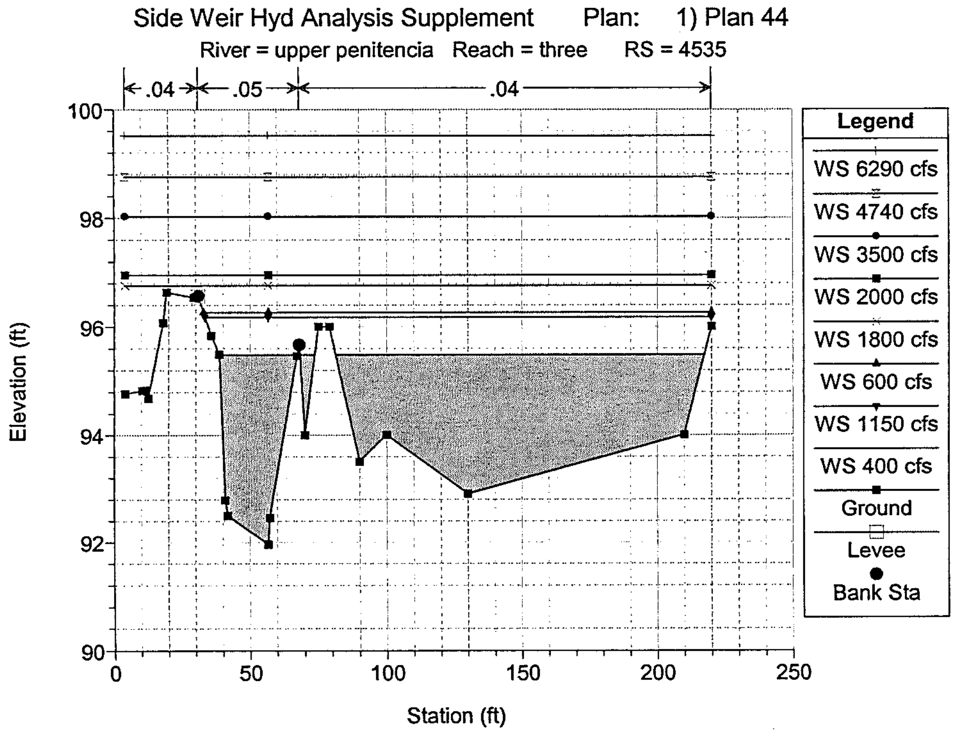
River = upper penitencia Reach = three RS = 4816 Private Road

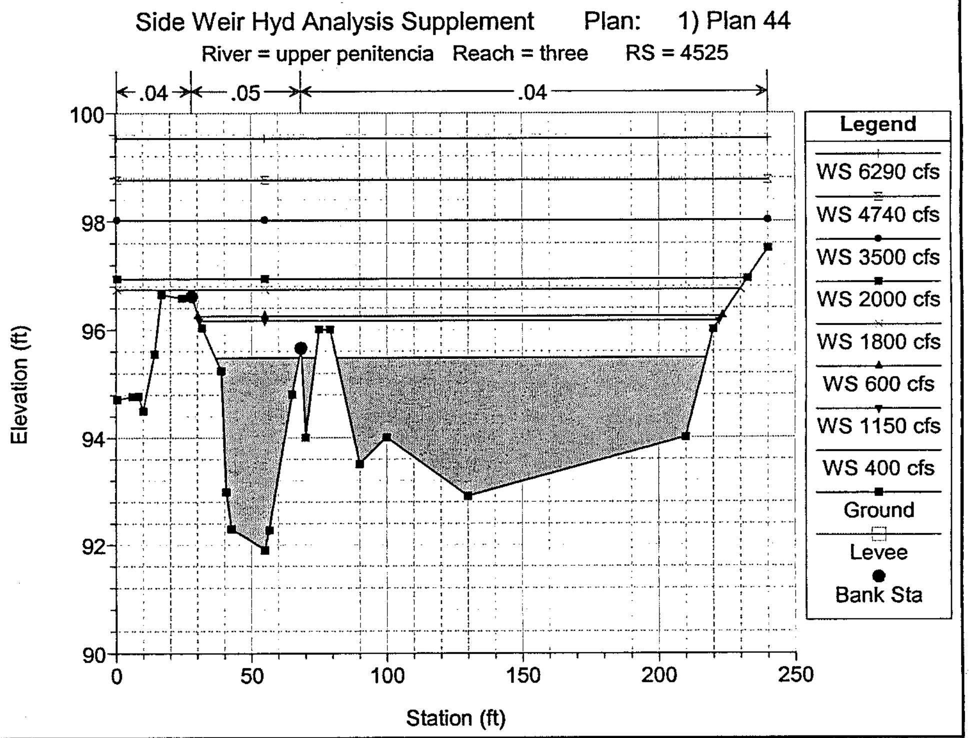

Side Weir Hyd Analysis Supplement Plan: 1) Plan 44

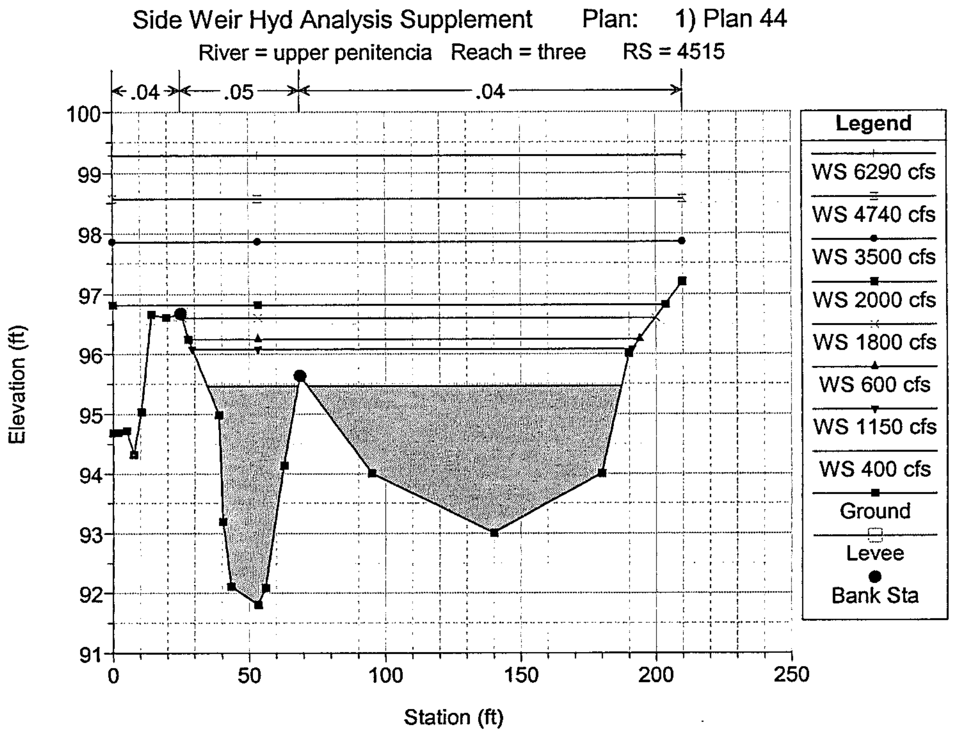
River = upper penitencia Reach = three RS = 4804

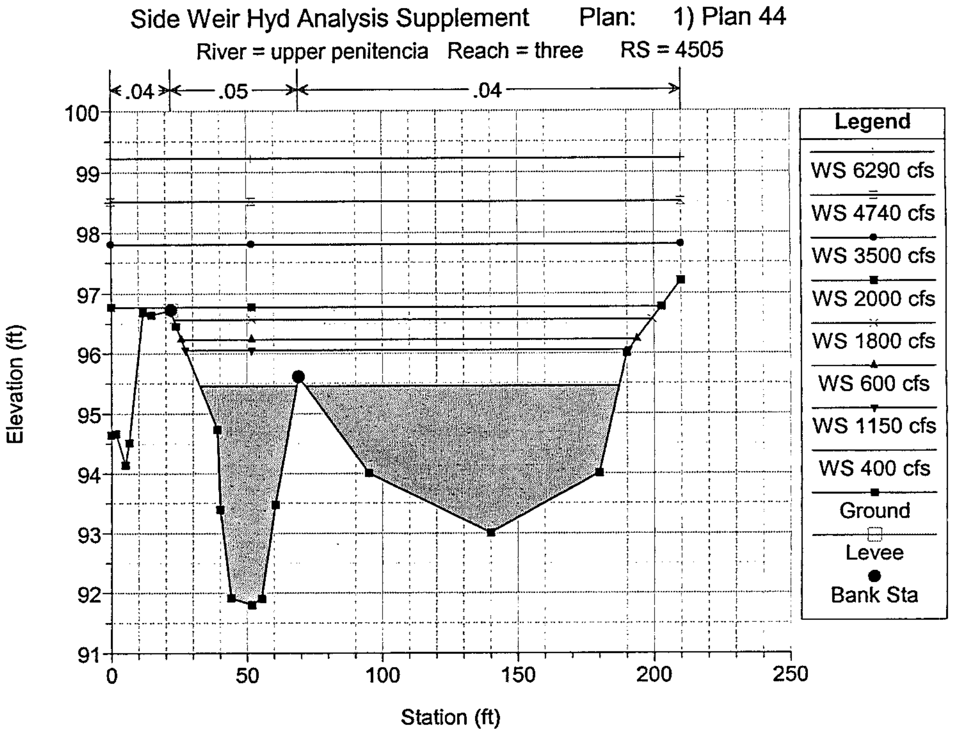

Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 4700
.04
.05
.04
Elevation (ft)
Station (ft)
101
100
99
98
97
96
95
94
93
-50
0
50
100
150
200
250
Legend
WS 6290 cfs
WS 4740 cfs
WS 3500 cfs
WS 2000 cfs
WS 1800 cfs
WS 1150 cfs
WS 600 cfs
WS 400 cfs
Ground
Levee
Bank Sta

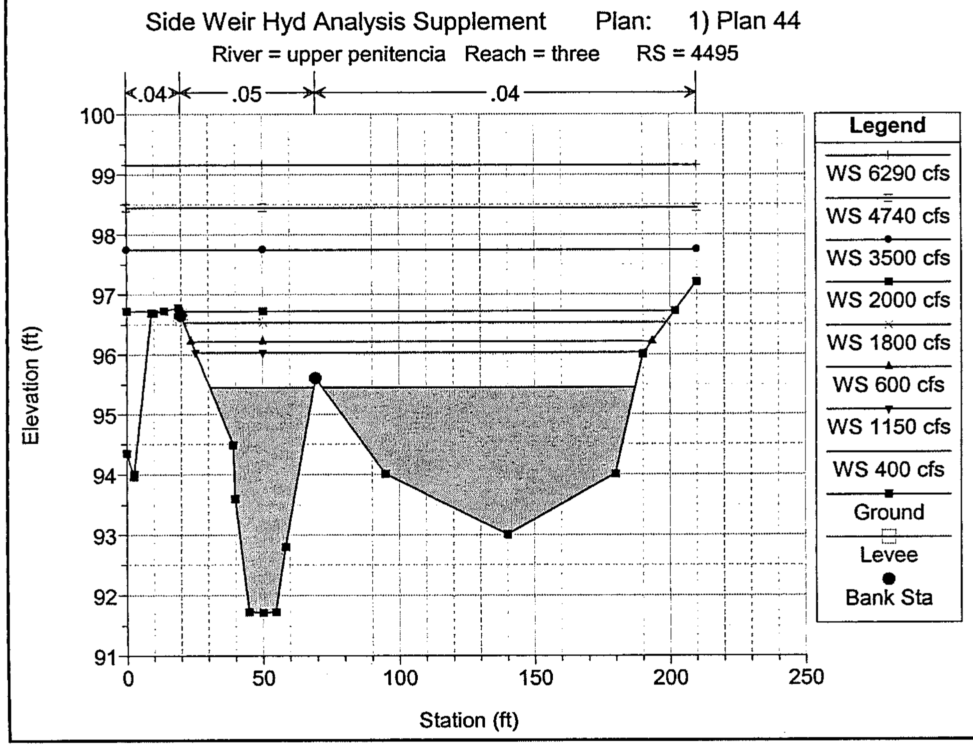

Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 4568
.04
.05
.04
Elevation (ft)
Station (ft)
100
98
96
94
92
0
50
100
150
200
250
300
Legend
WS 6290 cfs
WS 4740 cfs
WS 3500 cfs
WS 2000 cfs
WS 1800 cfs
WS 600 cfs
WS 1150 cfs
WS 400 cfs
Ground
Levee
Bank Sta

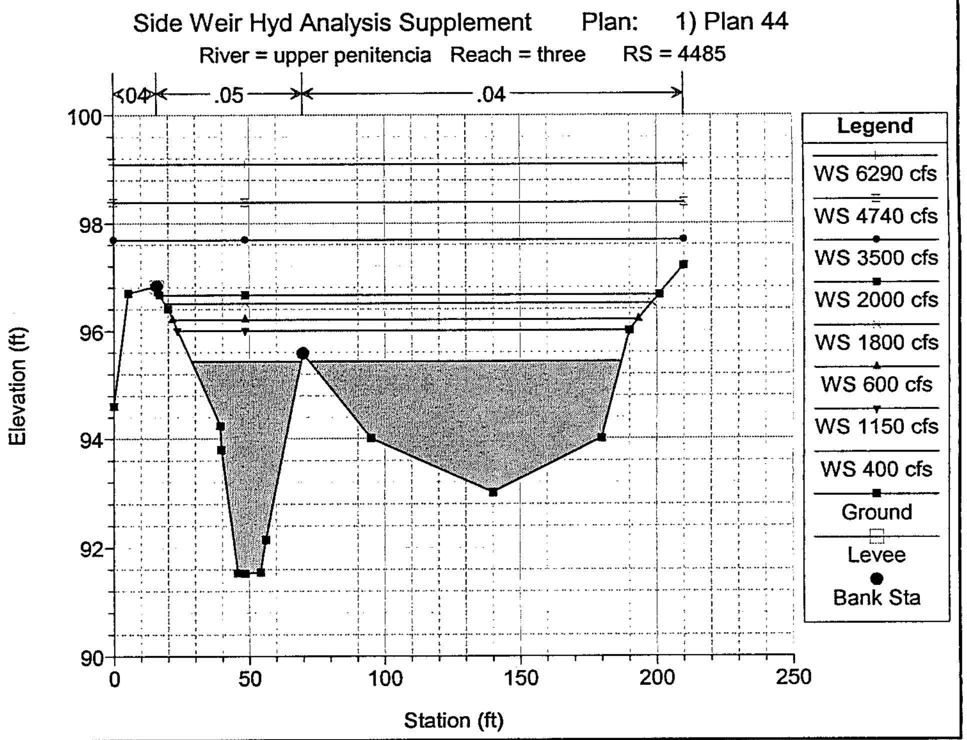

Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 4535
.04
.05
.04
Elevation (ft)
Station (ft)
100
98
96
94
92
90
0
50
100
150
200
250
Legend
WS 6290 cfs
WS 4740 cfs
WS 3500 cfs
WS 2000 cfs
WS 1800 cfs
WS 600 cfs
WS 1150 cfs
WS 400 cfs
Ground
Levee
Bank Sta

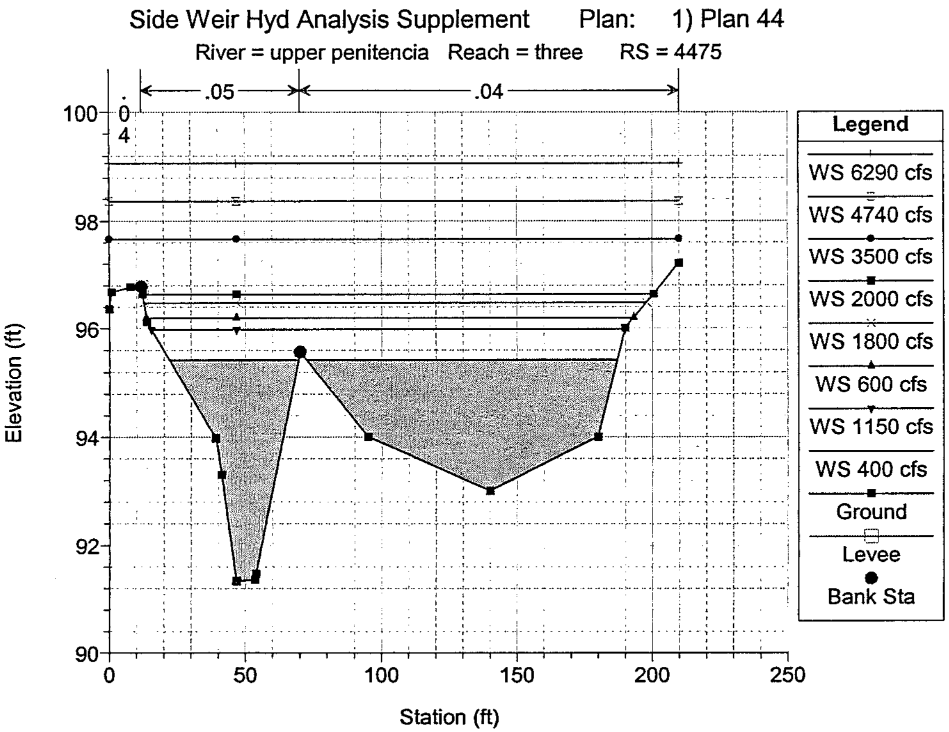

Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 4525
.04
.05
.04
Elevation (ft)
Station (ft)
100
98
96
94
92
90
0
50
100
150
200
250
Legend
WS 6290 cfs
WS 4740 cfs
WS 3500 cfs
WS 2000 cfs
WS 1800 cfs
WS 600 cfs
WS 1150 cfs
WS 400 cfs
Ground
Levee
Bank Sta

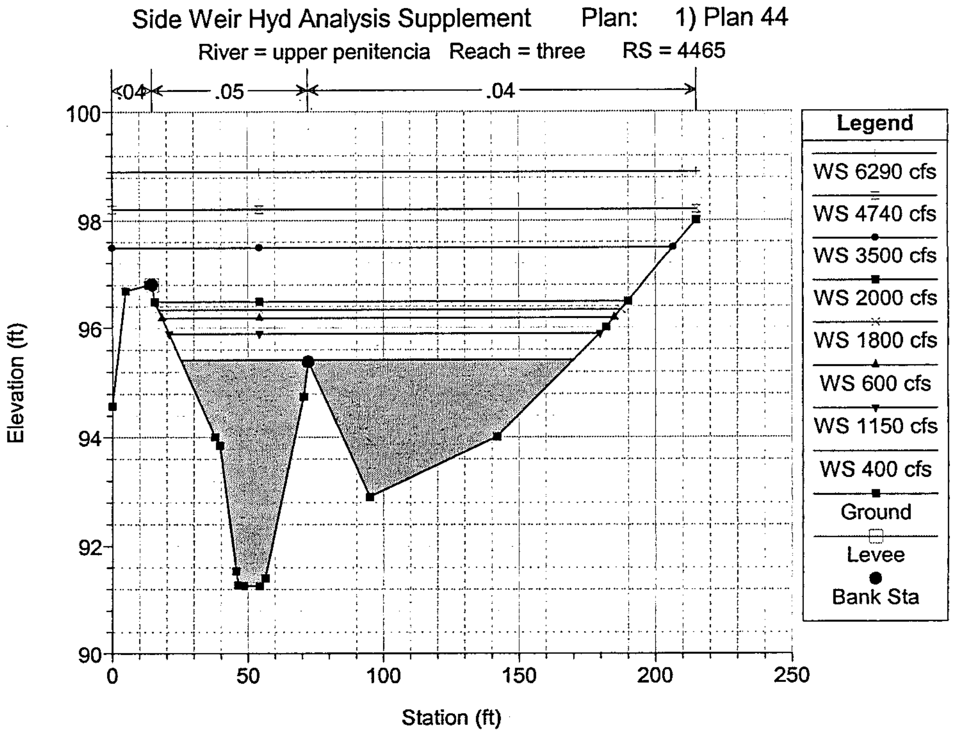

Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 4515
.04
.05
.04
Legend
WS 6290 cfs
WS 4740 cfs
WS 3500 cfs
WS 2000 cfs
WS 1800 cfs
WS 600 cfs
WS 1150 cfs
WS 400 cfs
Ground
Levee
Bank Sta
Elevation (ft)
100
99
98
97
96
95
94
93
92
91
0
50
100
150
200
250
Station (ft)

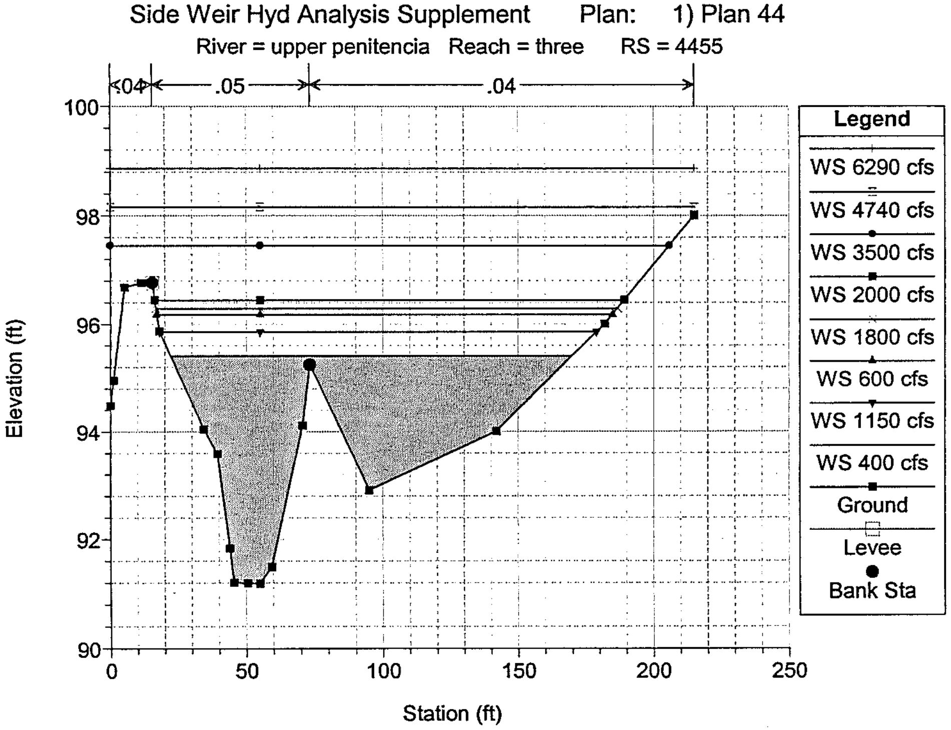

Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 4505
.04
.05
.04
Legend
WS 6290 cfs
WS 4740 cfs
WS 3500 cfs
WS 2000 cfs
WS 1800 cfs
WS 600 cfs
WS 1150 cfs
WS 400 cfs
Ground
Levee
Bank Sta
Elevation (ft)
100
99
98
97
96
95
94
93
92
91
0
50
100
150
200
250
Station (ft)

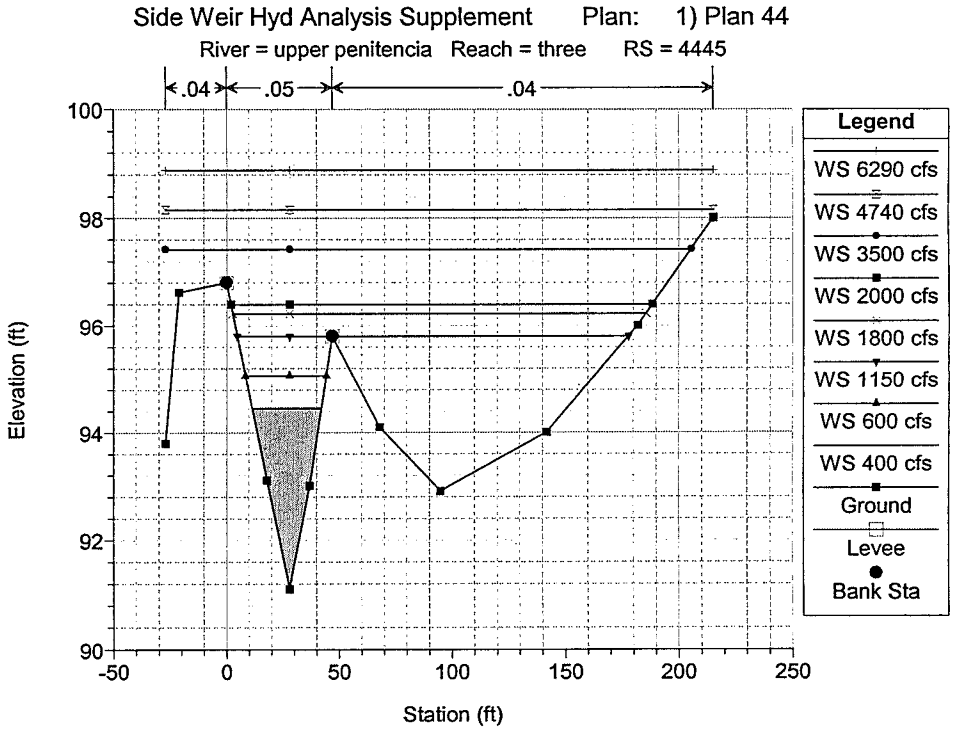

Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 4495
.04
.05
.04
Legend
WS 6290 cfs
WS 4740 cfs
WS 3500 cfs
WS 2000 cfs
WS 1800 cfs
WS 600 cfs
WS 1150 cfs
WS 400 cfs
Ground
Levee
Bank Sta
Elevation (ft)
100
99
98
97
96
95
94
93
92
91
0
50
100
150
200
250
Station (ft)

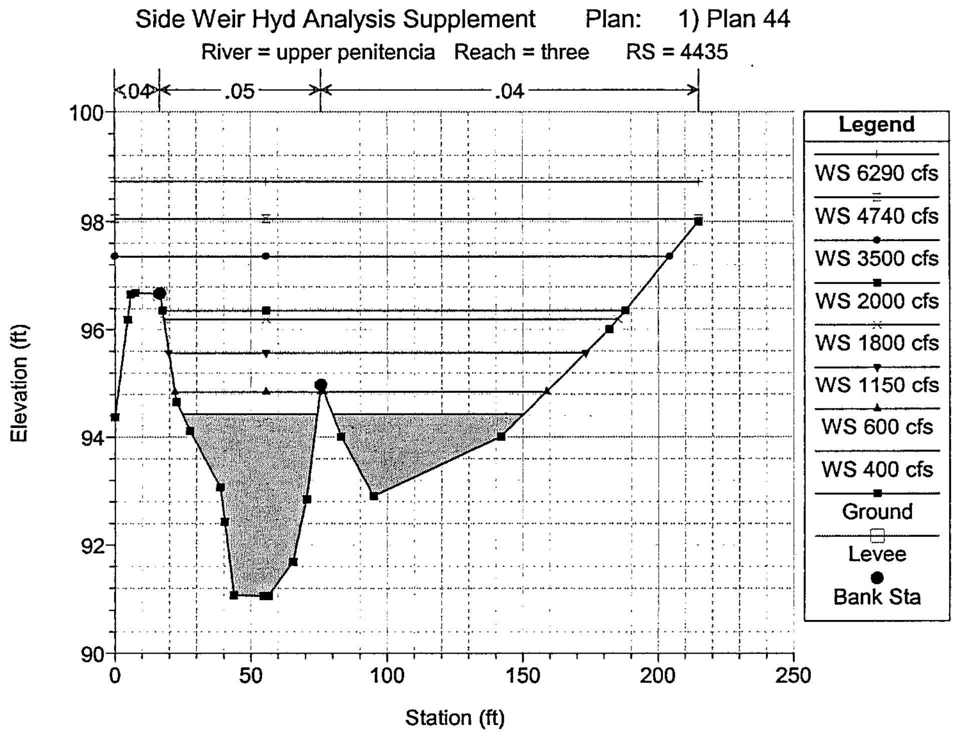

Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 4485
.04
.05
.04
Legend
WS 6290 cfs
WS 4740 cfs
WS 3500 cfs
WS 2000 cfs
WS 1800 cfs
WS 600 cfs
WS 1150 cfs
WS 400 cfs
Ground
Levee
Bank Sta
Elevation (ft)
100
98
96
94
92
90
0
50
100
150
200
250
Station (ft)

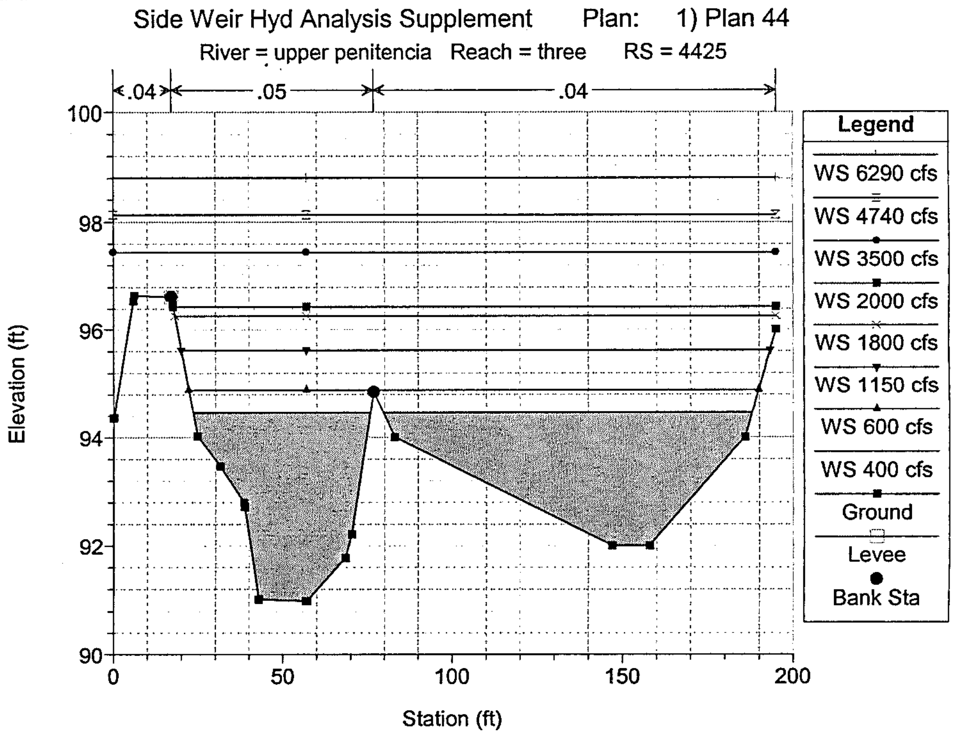

Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 4475

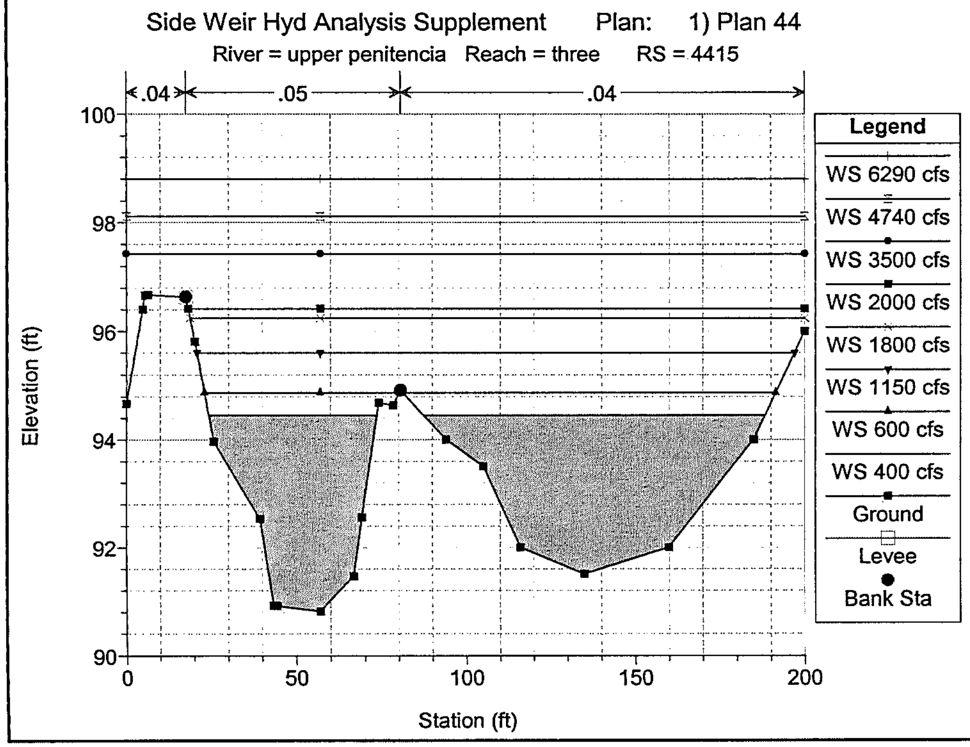

Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 4465

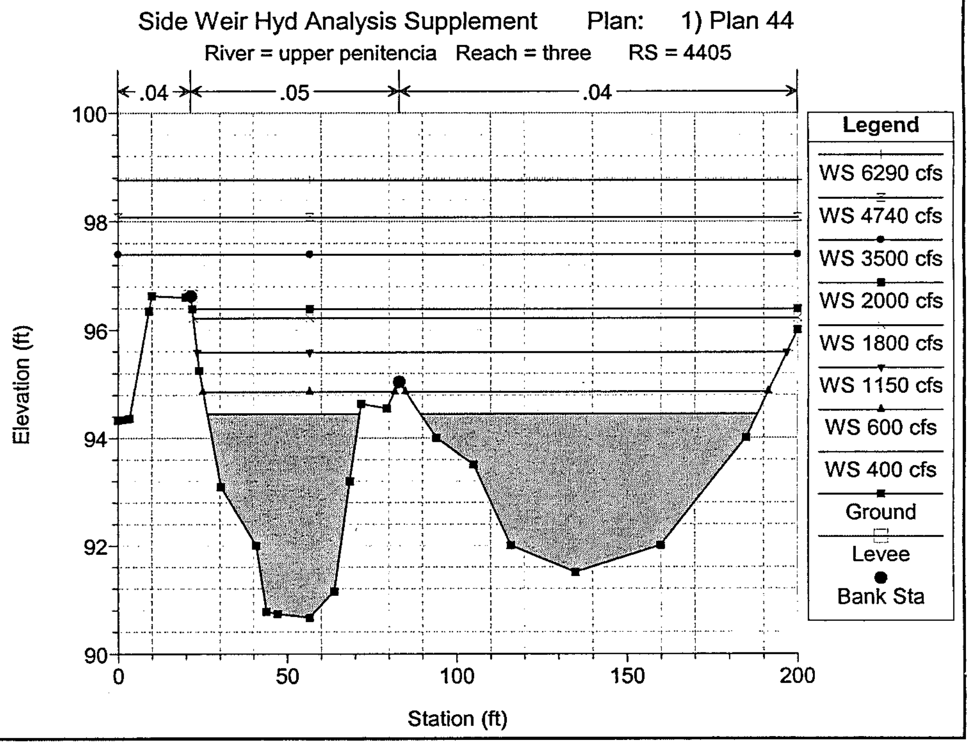

Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 4455


Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 4445

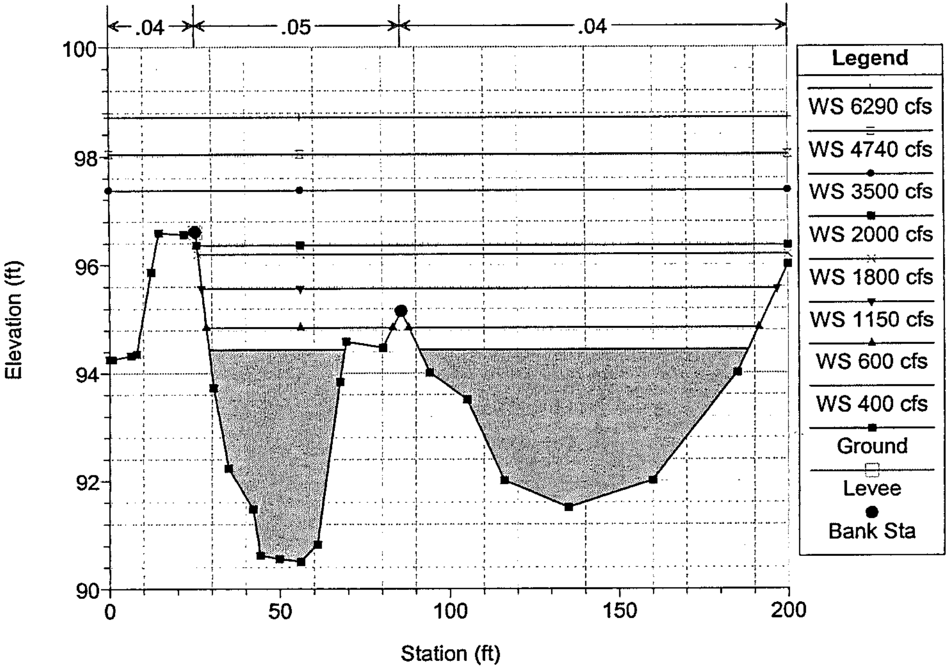

Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 4435
.04
.05
.04
Elevation (ft)
100
98
96
94
92
90
0
50
100
150
200
250
Station (ft)
Legend
WS 6290 cfs
WS 4740 cfs
WS 3500 cfs
WS 2000 cfs
WS 1800 cfs
WS 1150 cfs
WS 600 cfs
WS 400 cfs
Ground
Levee
Bank Sta


Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 4425
.04
.05
.04
Elevation (ft)
100
98
96
94
92
90
0
50
100
150
200
Station (ft)
Legend
WS 6290 cfs
WS 4740 cfs
WS 3500 cfs
WS 2000 cfs
WS 1800 cfs
WS 1150 cfs
WS 600 cfs
WS 400 cfs
Ground
Levee
Bank Sta

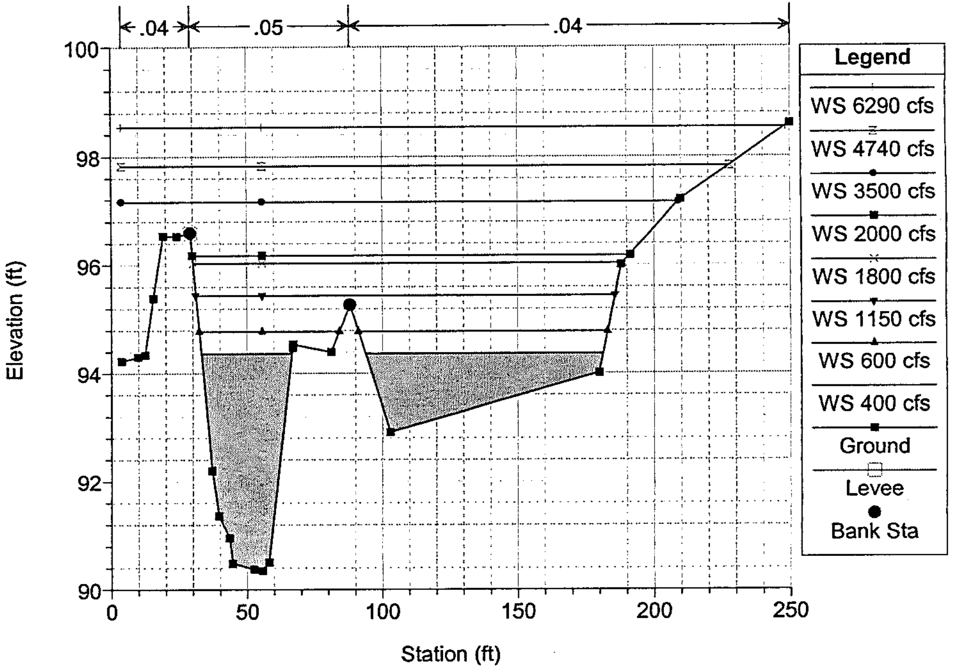

Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 4415
.04
.05
.04
Elevation (ft)
100
98
96
94
92
90
0
50
100
150
200
Station (ft)
Legend
WS 6290 cfs
WS 4740 cfs
WS 3500 cfs
WS 2000 cfs
WS 1800 cfs
WS 1150 cfs
WS 600 cfs
WS 400 cfs
Ground
Levee
Bank Sta


Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 4405
.04
.05
.04
Elevation (ft)
100
98
96
94
92
90
0
50
100
150
200
Station (ft)
Legend
WS 6290 cfs
WS 4740 cfs
WS 3500 cfs
WS 2000 cfs
WS 1800 cfs
WS 1150 cfs
WS 600 cfs
WS 400 cfs
Ground
Levee
Bank Sta

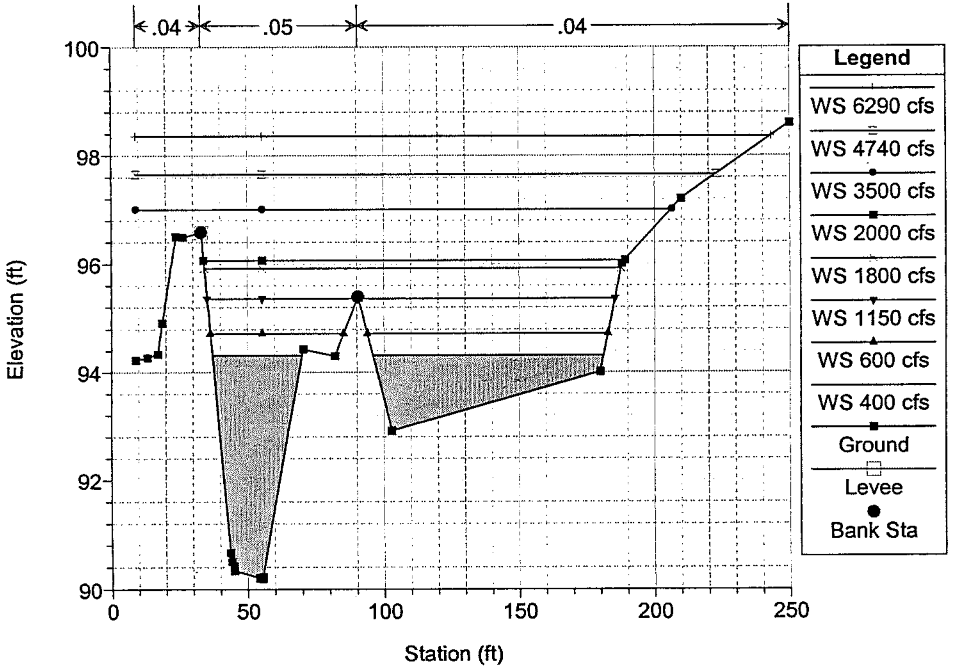
Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 4395



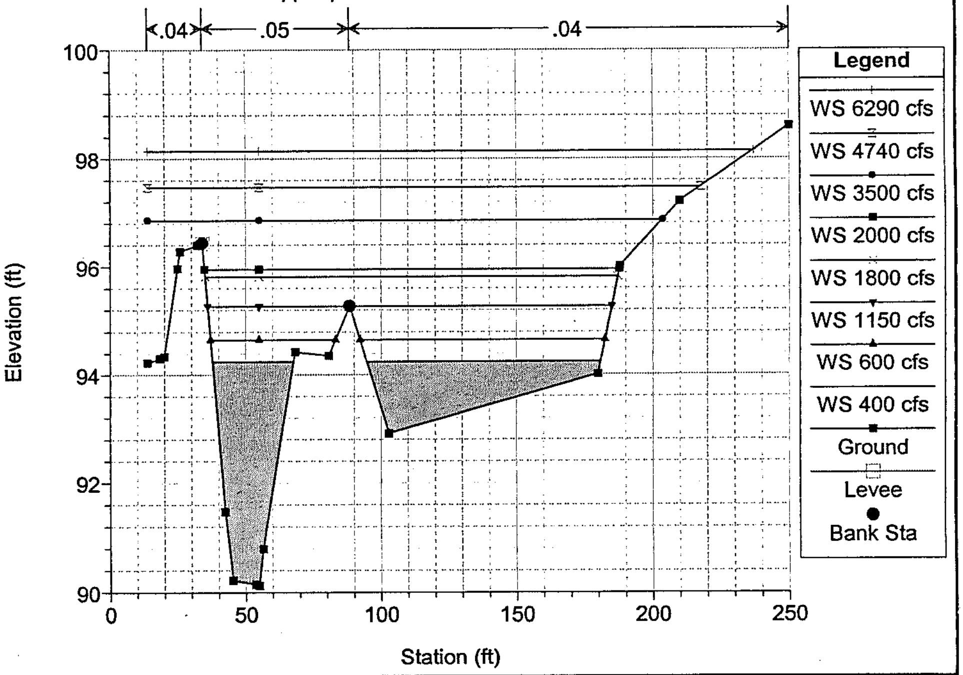
Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 4385

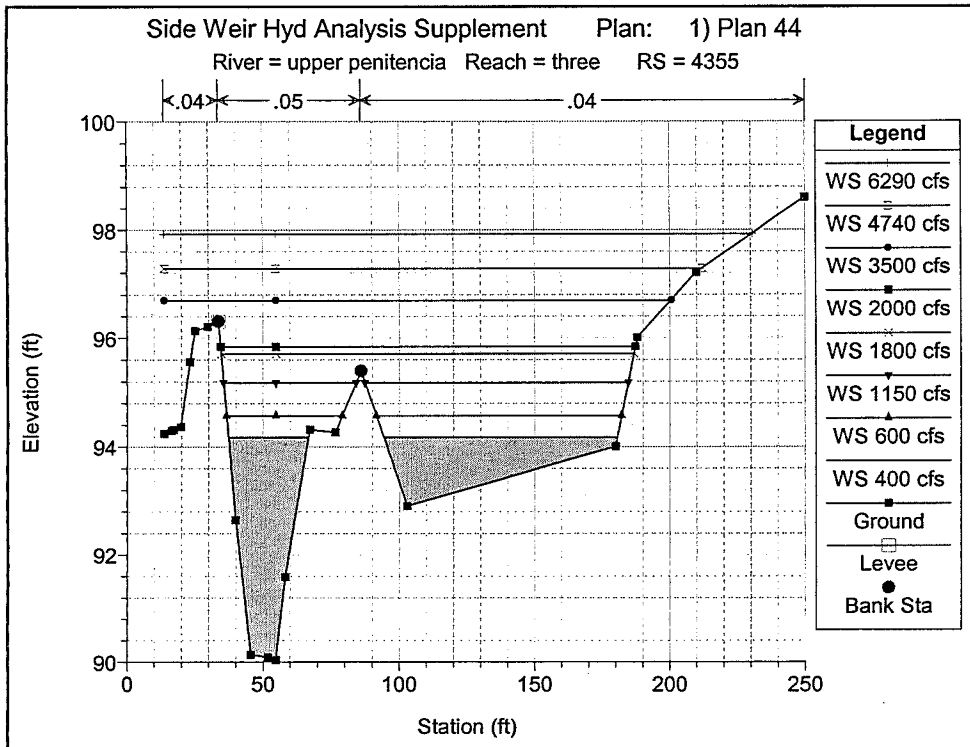


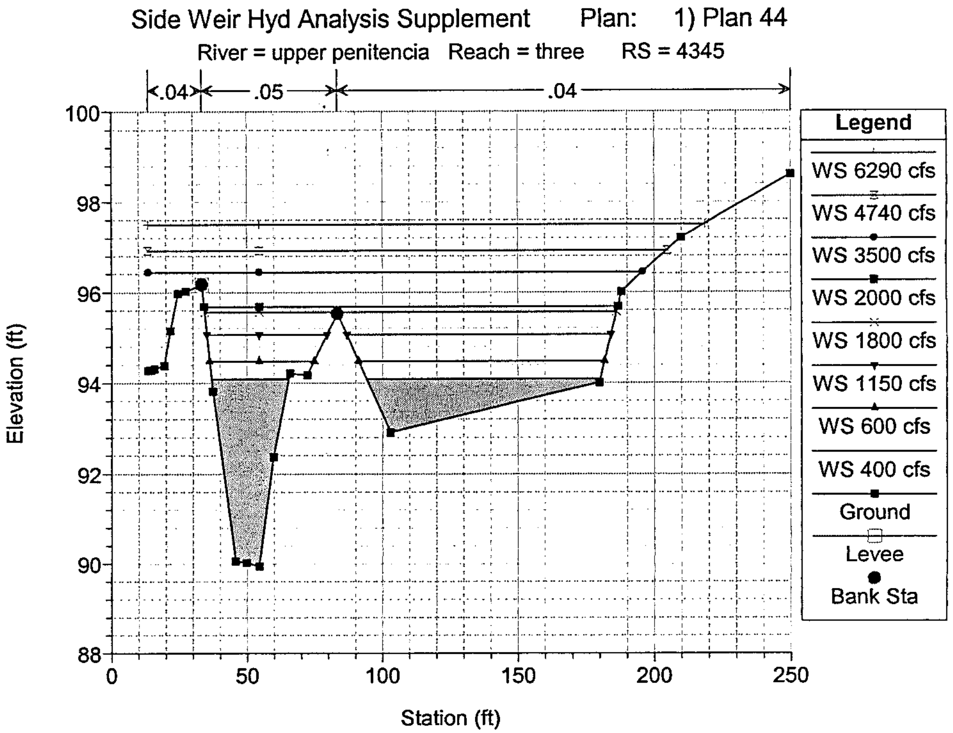
Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 4375

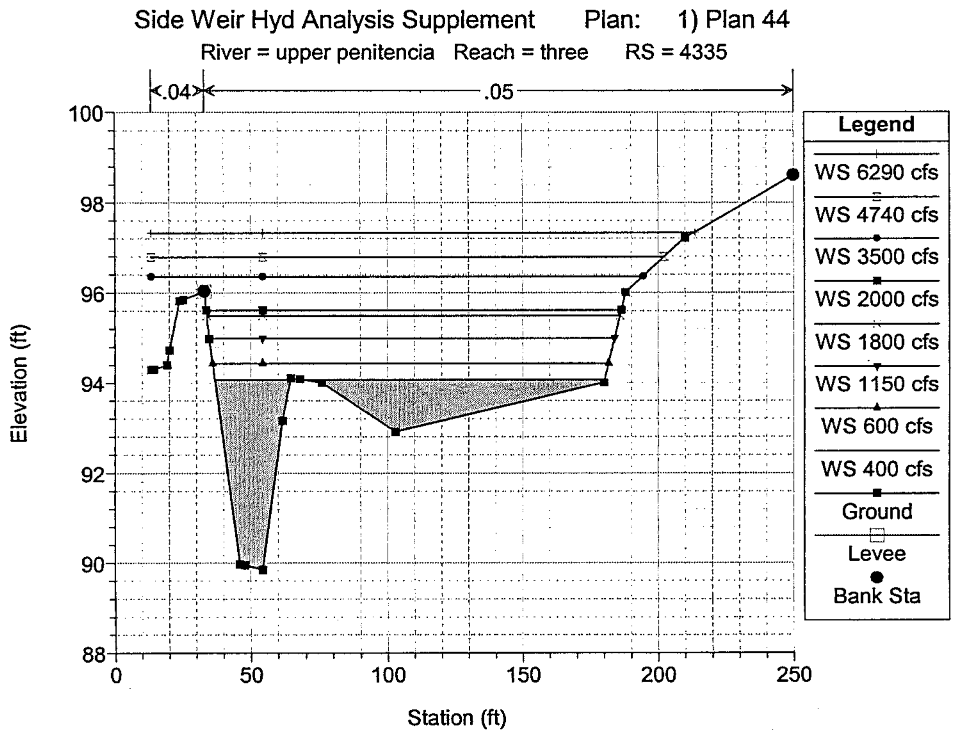


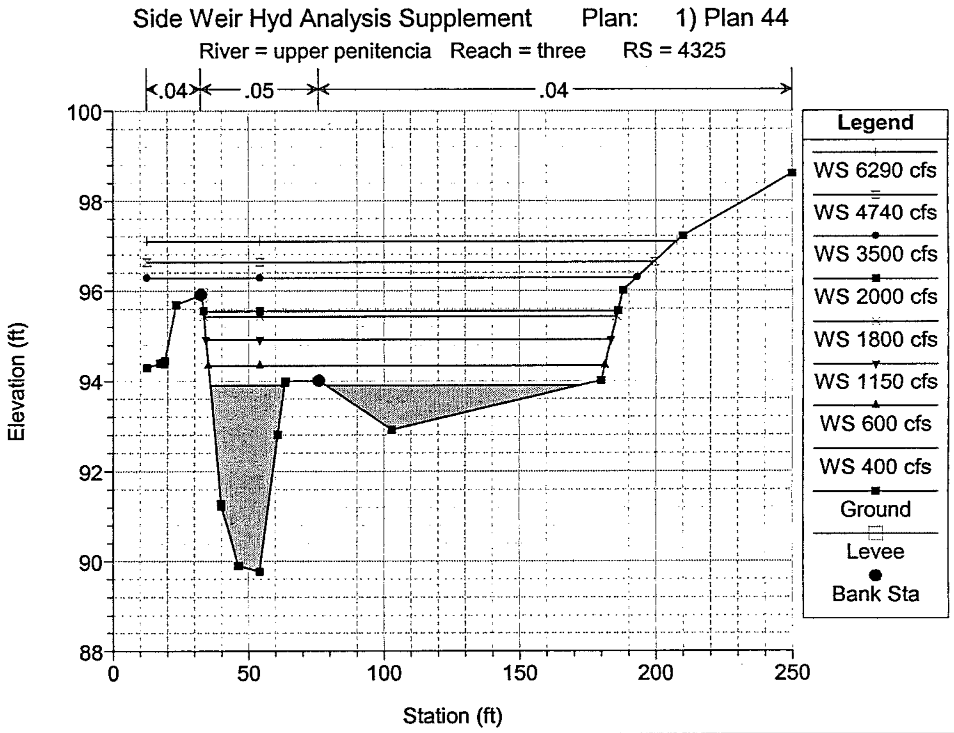
Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 4365

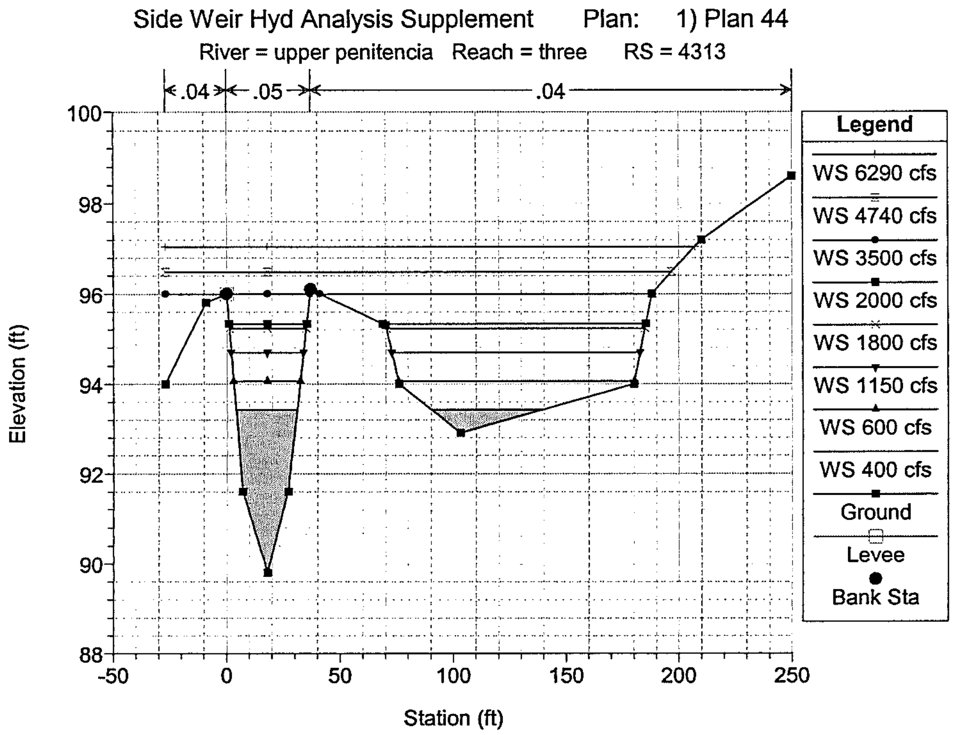


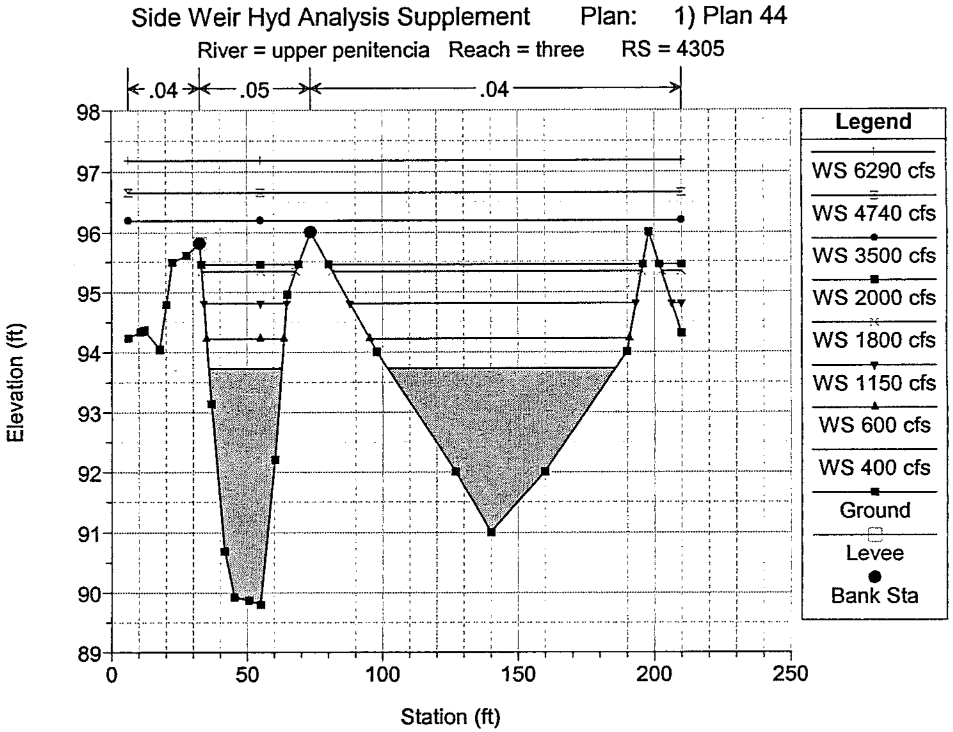

Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 4355
.04
.05
.04
Elevation (ft)
100
98
96
94
92
90
0
50
100
150
200
250
Station (ft)
Legend
WS 6290 cfs
WS 4740 cfs
WS 3500 cfs
WS 2000 cfs
WS 1800 cfs
WS 1150 cfs
WS 600 cfs
WS 400 cfs
Ground
Levee
Bank Sta

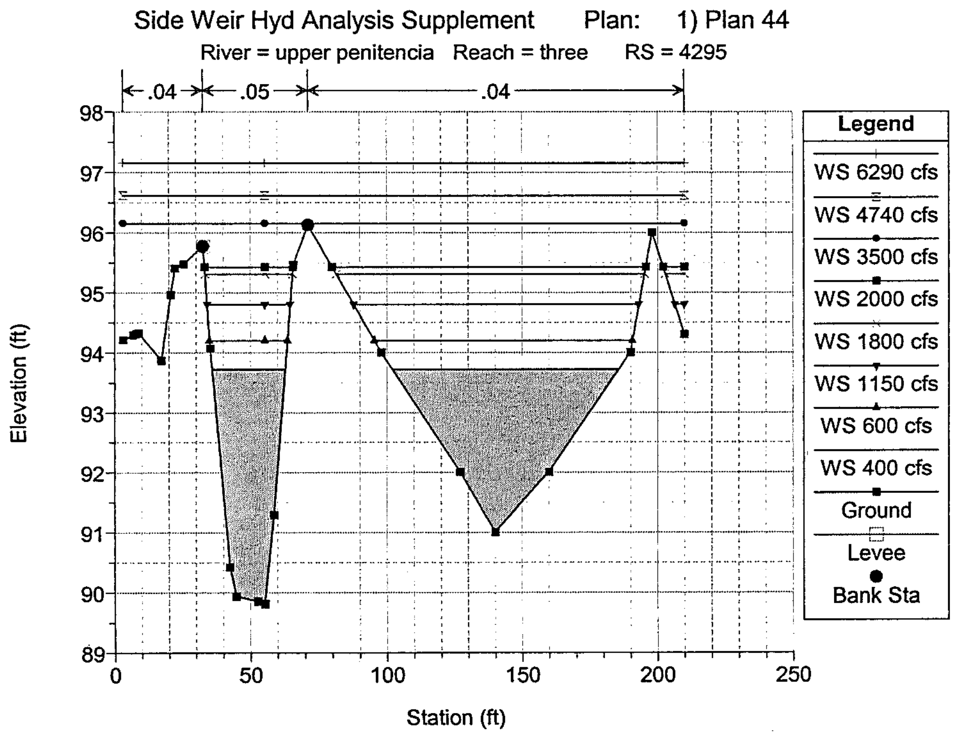

Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 4345
.04
.05
.04
Elevation (ft)
100
98
96
94
92
90
88
0
50
100
150
200
250
Station (ft)
Legend
WS 6290 cfs
WS 4740 cfs
WS 3500 cfs
WS 2000 cfs
WS 1800 cfs
WS 1150 cfs
WS 600 cfs
WS 400 cfs
Ground
Levee
Bank Sta

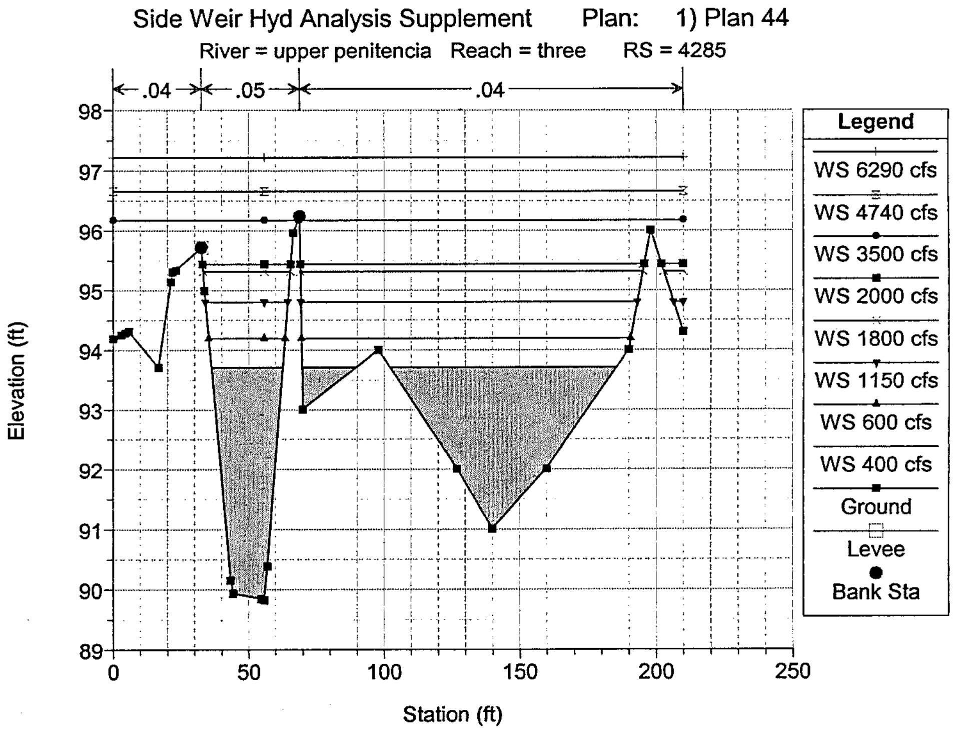

Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 4335
.04
.05
Elevation (ft)
100
98
96
94
92
90
88
0
50
100
150
200
250
Station (ft)
Legend
WS 6290 cfs
WS 4740 cfs
WS 3500 cfs
WS 2000 cfs
WS 1800 cfs
WS 1150 cfs
WS 600 cfs
WS 400 cfs
Ground
Levee
Bank Sta

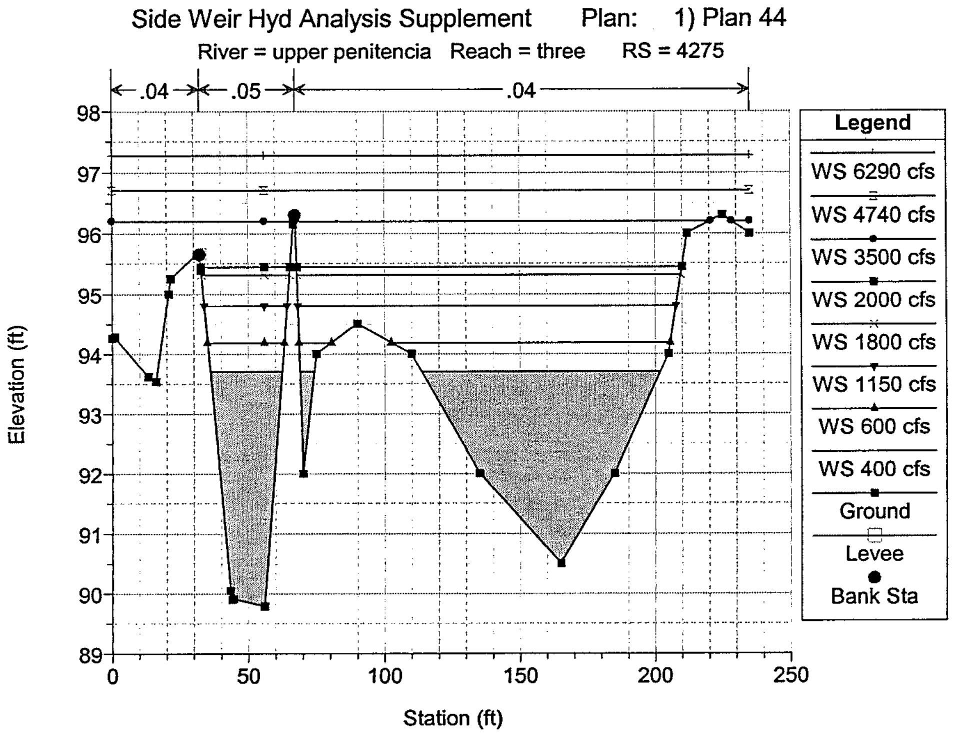

Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 4325
.04
.05
.04
Elevation (ft)
100
98
96
94
92
90
88
0
50
100
150
200
250
Station (ft)
Legend
WS 6290 cfs
WS 4740 cfs
WS 3500 cfs
WS 2000 cfs
WS 1800 cfs
WS 1150 cfs
WS 600 cfs
WS 400 cfs
Ground
Levee
Bank Sta

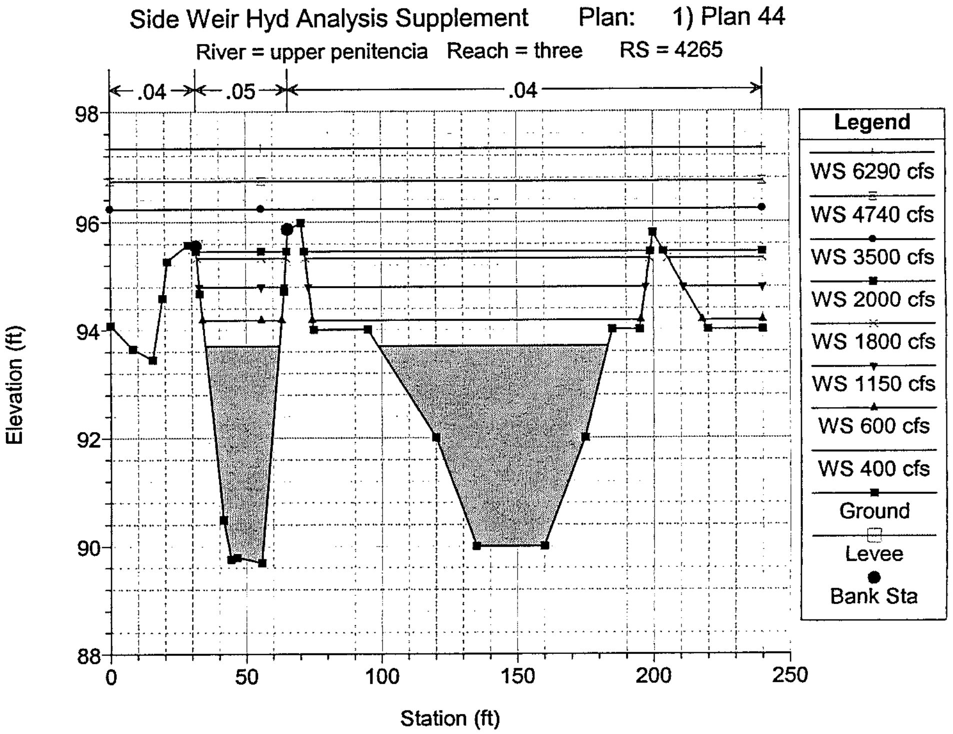

Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 4313
.04
.05
.04
Elevation (ft)
100
98
96
94
92
90
88
Station (ft)
-50
0
50
100
150
200
250
Legend
WS 6290 cfs
WS 4740 cfs
WS 3500 cfs
WS 2000 cfs
WS 1800 cfs
WS 1150 cfs
WS 600 cfs
WS 400 cfs
Ground
Levee
Bank Sta

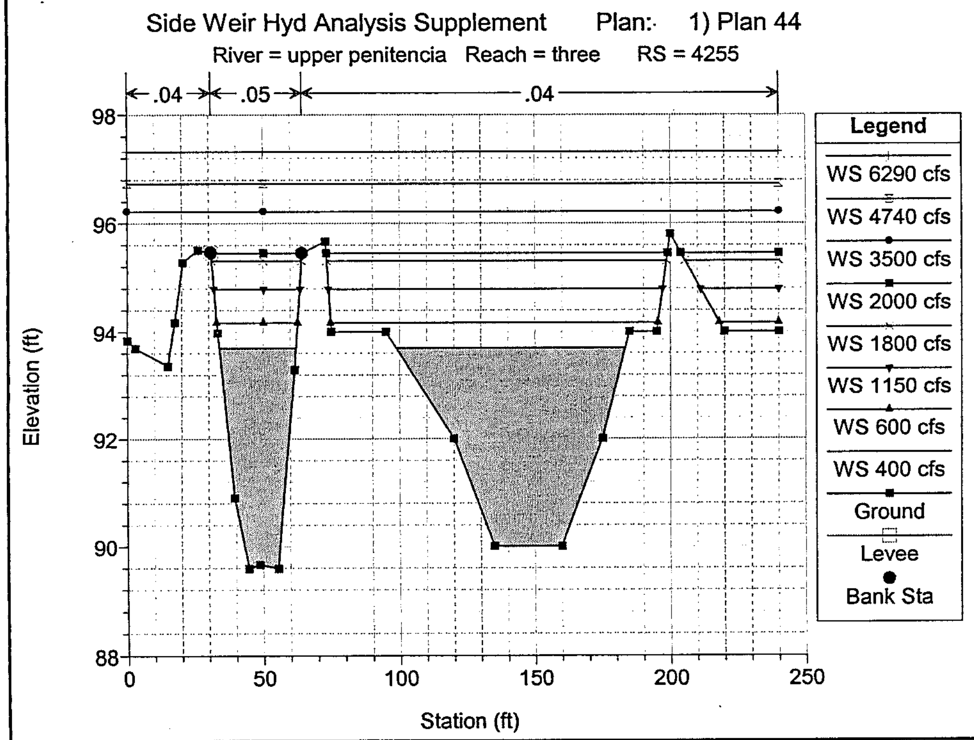

Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 4305
.04
.05
.04
Elevation (ft)
98
97
96
95
94
93
92
91
90
89
Station (ft)
0
50
100
150
200
250
Legend
WS 6290 cfs
WS 4740 cfs
WS 3500 cfs
WS 2000 cfs
WS 1800 cfs
WS 1150 cfs
WS 600 cfs
WS 400 cfs
Ground
Levee
Bank Sta

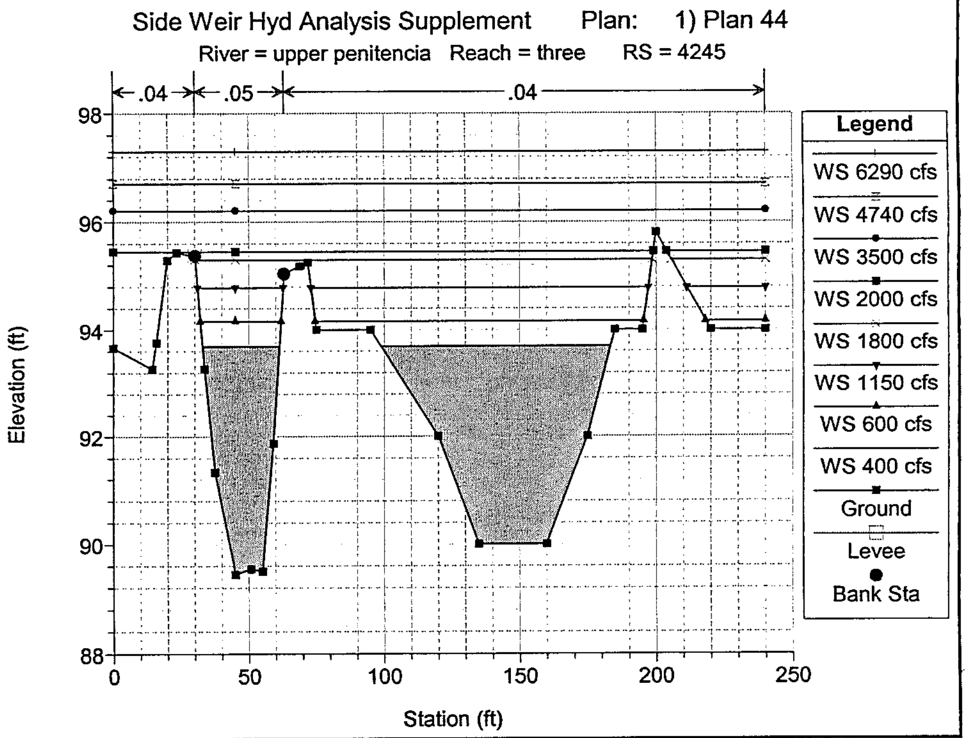

Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 4295
.04
.05
.04
Elevation (ft)
98
97
96
95
94
93
92
91
90
89
Station (ft)
0
50
100
150
200
250
Legend
WS 6290 cfs
WS 4740 cfs
WS 3500 cfs
WS 2000 cfs
WS 1800 cfs
WS 1150 cfs
WS 600 cfs
WS 400 cfs
Ground
Levee
Bank Sta

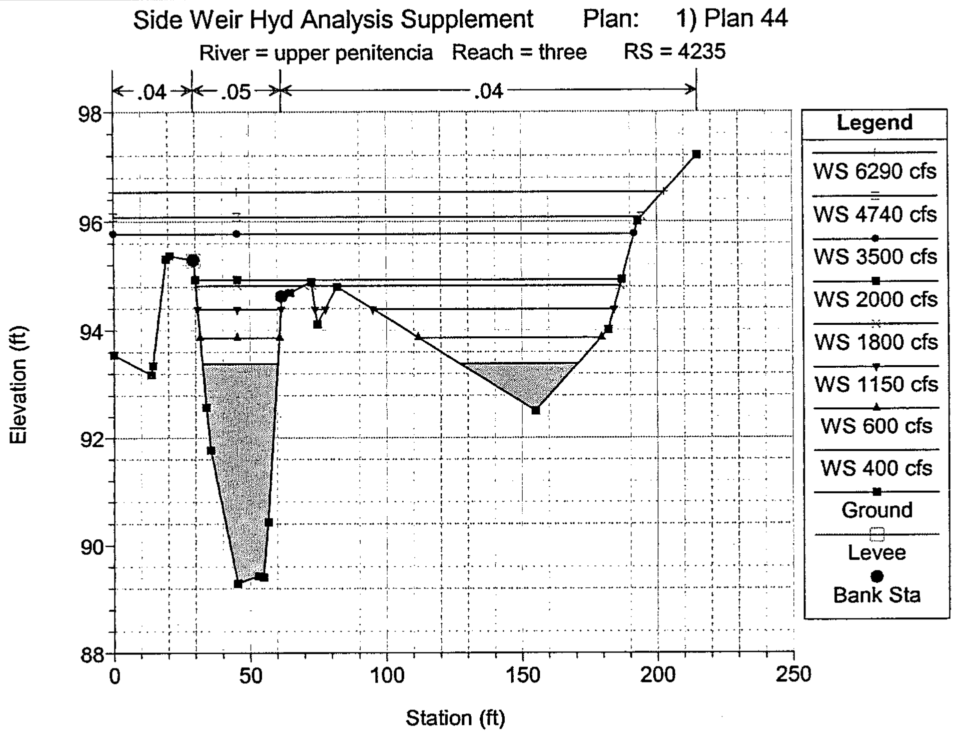

Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 4285
.04
.05
.04
Elevation (ft)
98
97
96
95
94
93
92
91
90
89
Station (ft)
0
50
100
150
200
250
Legend
WS 6290 cfs
WS 4740 cfs
WS 3500 cfs
WS 2000 cfs
WS 1800 cfs
WS 1150 cfs
WS 600 cfs
WS 400 cfs
Ground
Levee
Bank Sta

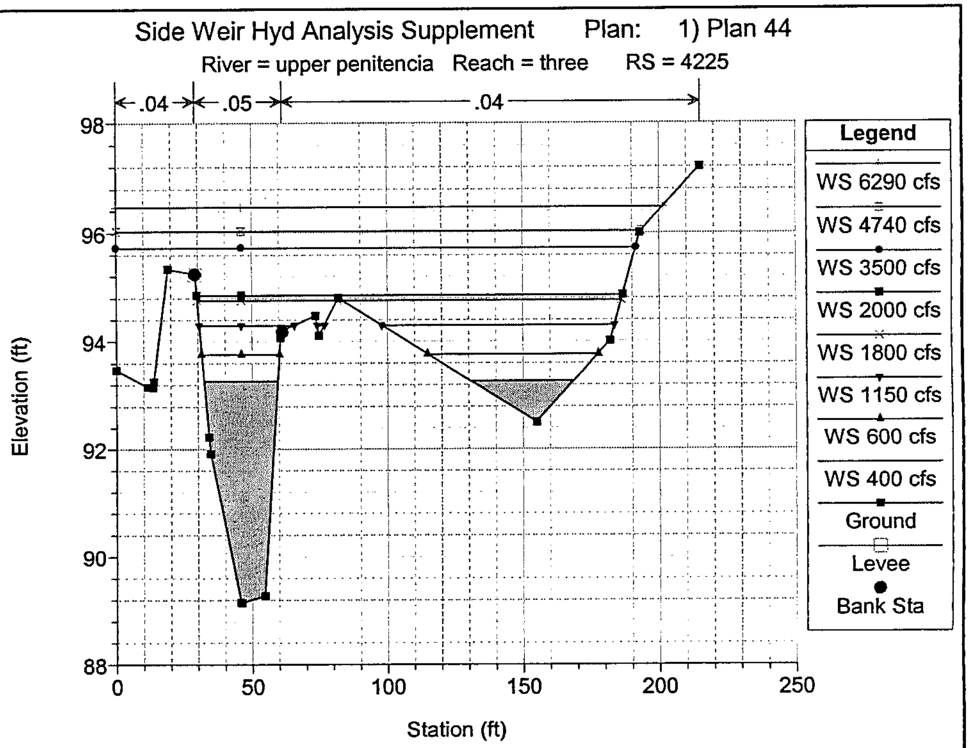

Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 4275
.04
.05
.04
Elevation (ft)
98
97
96
95
94
93
92
91
90
89
0
50
100
150
200
250
Station (ft)
Legend
WS 6290 cfs
WS 4740 cfs
WS 3500 cfs
WS 2000 cfs
WS 1800 cfs
WS 1150 cfs
WS 600 cfs
WS 400 cfs
Ground
Levee
Bank Sta

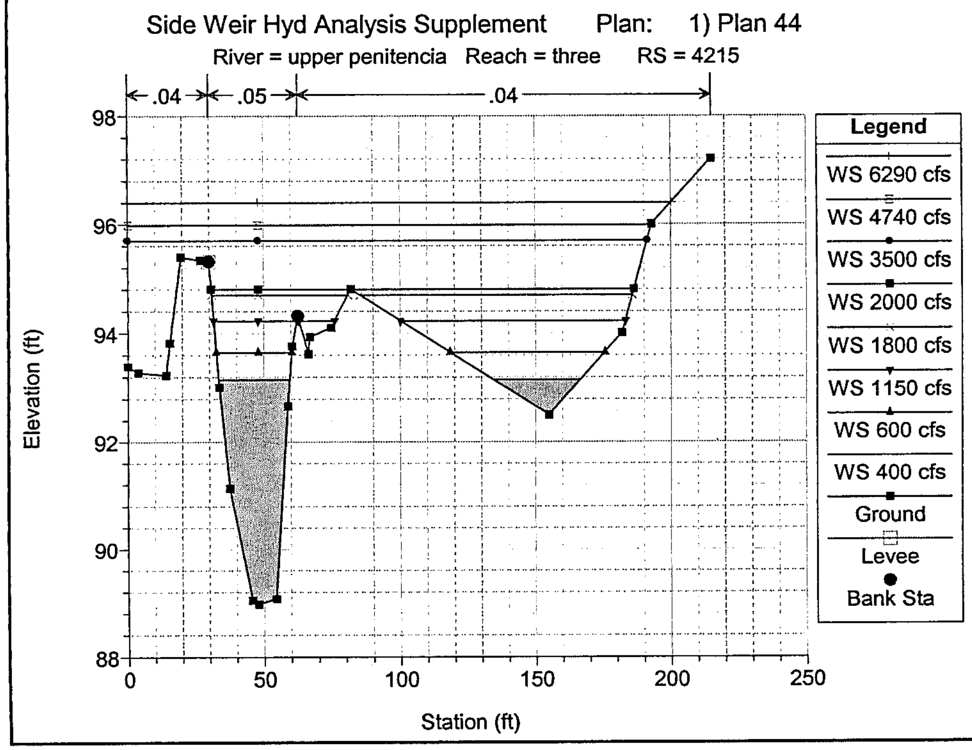

Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 4265
.04
.05
.04
Elevation (ft)
98
96
94
92
90
88
0
50
100
150
200
250
Station (ft)
Legend
WS 6290 cfs
WS 4740 cfs
WS 3500 cfs
WS 2000 cfs
WS 1800 cfs
WS 1150 cfs
WS 600 cfs
WS 400 cfs
Ground
Levee
Bank Sta

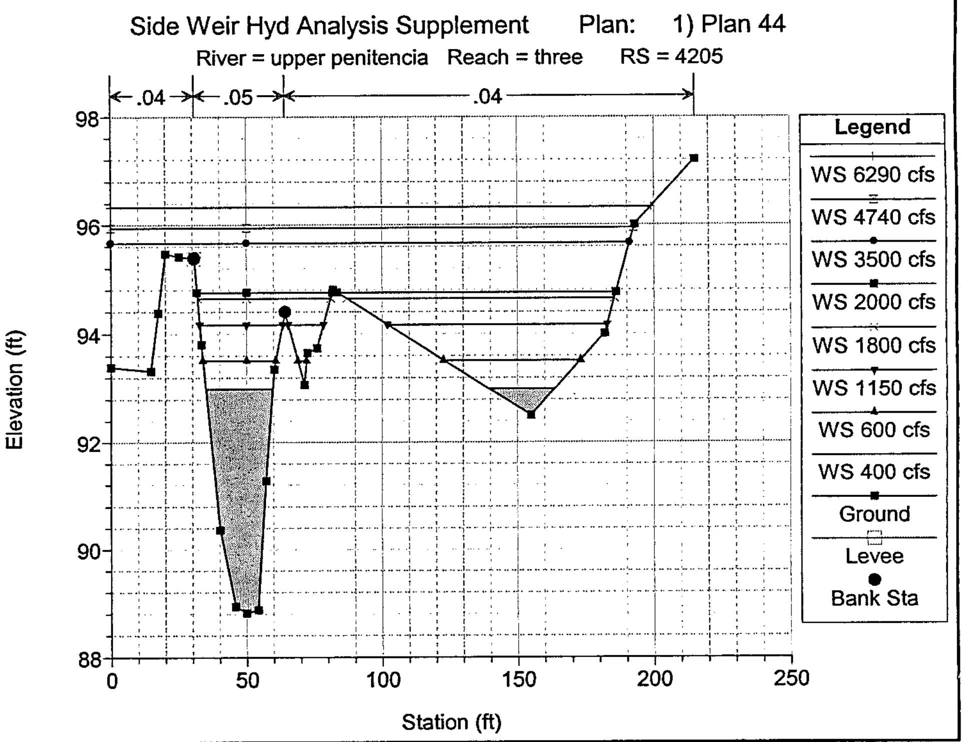

Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 4255
.04
.05
.04
Elevation (ft)
98
96
94
92
90
88
0
50
100
150
200
250
Station (ft)
Legend
WS 6290 cfs
WS 4740 cfs
WS 3500 cfs
WS 2000 cfs
WS 1800 cfs
WS 1150 cfs
WS 600 cfs
WS 400 cfs
Ground
Levee
Bank Sta

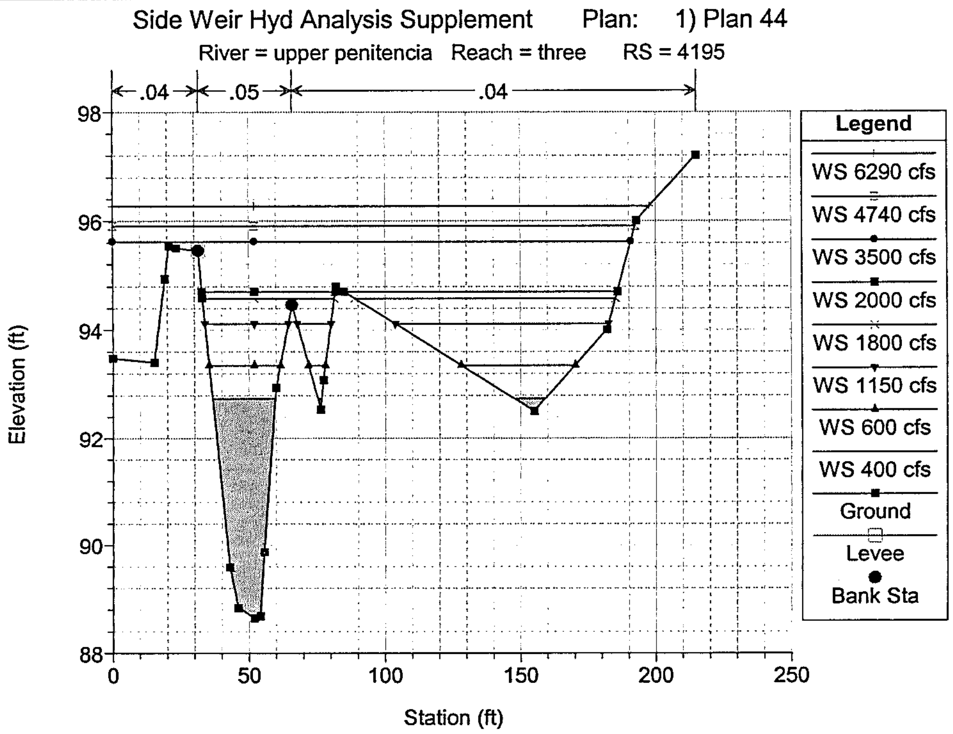

Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 4245
.04
.05
.04
Elevation (ft)
98
96
94
92
90
88
0
50
100
150
200
250
Station (ft)
Legend
WS 6290 cfs
WS 4740 cfs
WS 3500 cfs
WS 2000 cfs
WS 1800 cfs
WS 1150 cfs
WS 600 cfs
WS 400 cfs
Ground
Levee
Bank Sta

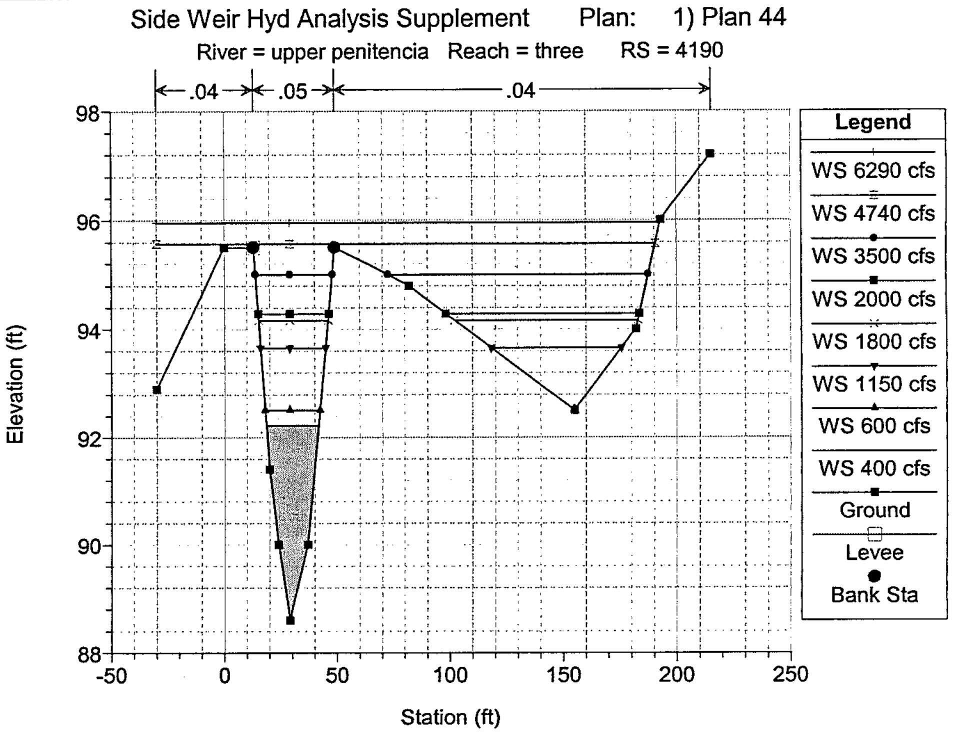

Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 4235
.04
.05
.04
Legend
WS 6290 cfs
WS 4740 cfs
WS 3500 cfs
WS 2000 cfs
WS 1800 cfs
WS 1150 cfs
WS 600 cfs
WS 400 cfs
Ground
Levee
Bank Sta
Elevation (ft)
98
96
94
92
90
88
0
50
100
150
200
250
Station (ft)

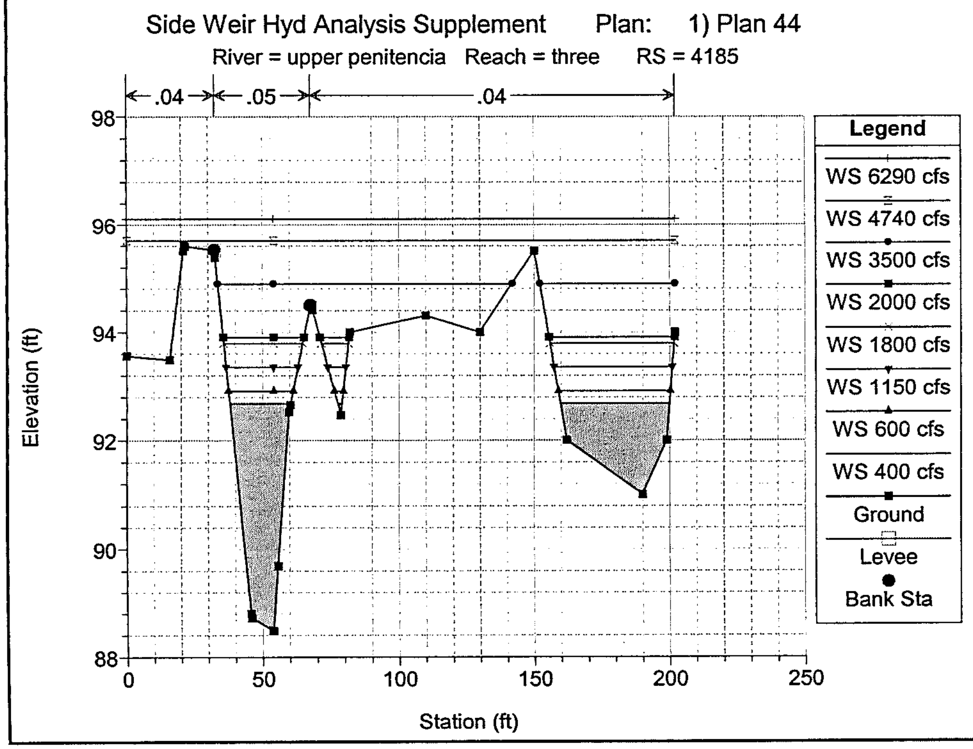

Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 4225
.04
.05
.04
Legend
WS 6290 cfs
WS 4740 cfs
WS 3500 cfs
WS 2000 cfs
WS 1800 cfs
WS 1150 cfs
WS 600 cfs
WS 400 cfs
Ground
Levee
Bank Sta
Elevation (ft)
98
96
94
92
90
88
0
50
100
150
200
250
Station (ft)

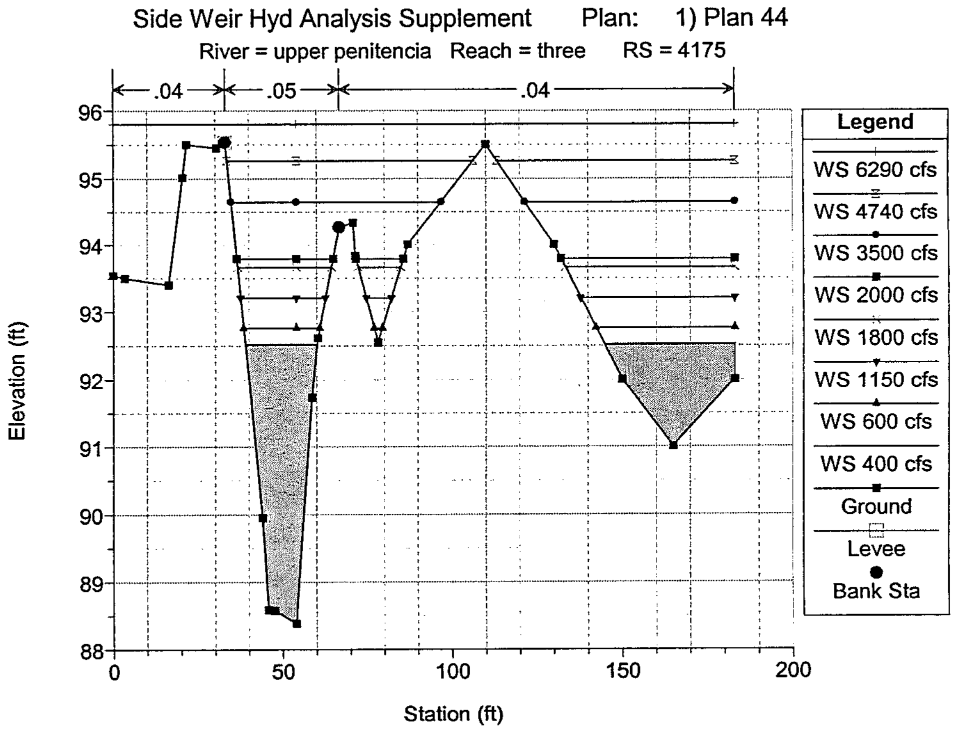

Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 4215
.04
.05
.04
Legend
WS 6290 cfs
WS 4740 cfs
WS 3500 cfs
WS 2000 cfs
WS 1800 cfs
WS 1150 cfs
WS 600 cfs
WS 400 cfs
Ground
Levee
Bank Sta
Elevation (ft)
98
96
94
92
90
88
0
50
100
150
200
250
Station (ft)

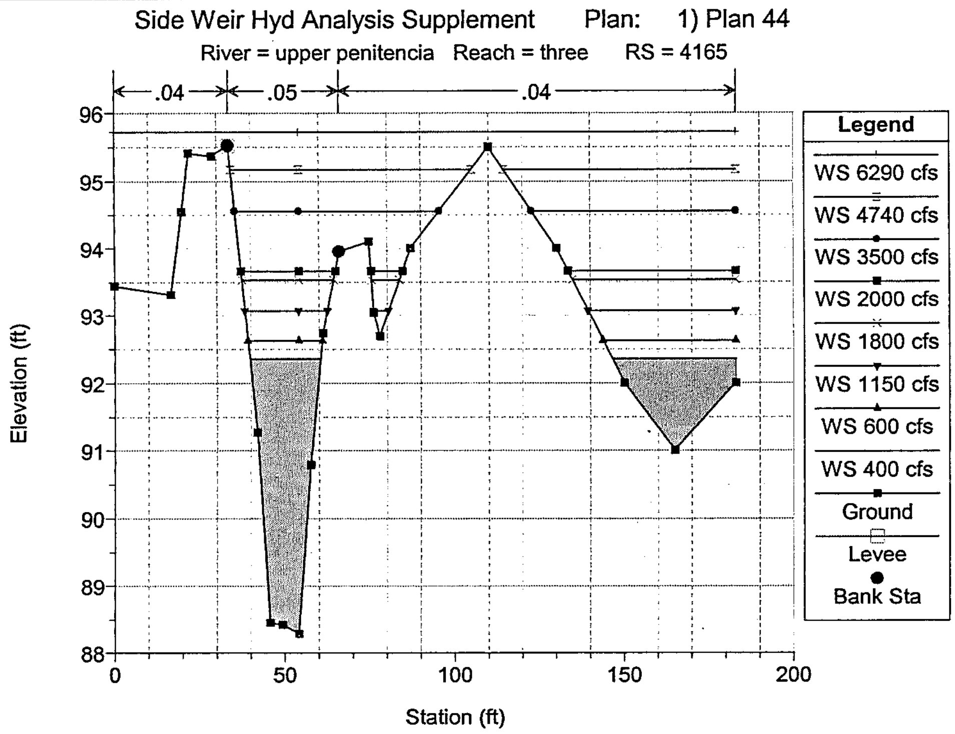

Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 4205
.04
.05
.04
Legend
WS 6290 cfs
WS 4740 cfs
WS 3500 cfs
WS 2000 cfs
WS 1800 cfs
WS 1150 cfs
WS 600 cfs
WS 400 cfs
Ground
Levee
Bank Sta
Elevation (ft)
98
96
94
92
90
88
0
50
100
150
200
250
Station (ft)


Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 4195
.04
.05
.04
Elevation (ft)
98
96
94
92
90
88
Station (ft)
0
50
100
150
200
250
Legend
WS 6290 cfs
WS 4740 cfs
WS 3500 cfs
WS 2000 cfs
WS 1800 cfs
WS 1150 cfs
WS 600 cfs
WS 400 cfs
Ground
Levee
Bank Sta


Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 4190
.04
.05
.04
Elevation (ft)
98
96
94
92
90
88
Station (ft)
-50
0
50
100
150
200
250
Legend
WS 6290 cfs
WS 4740 cfs
WS 3500 cfs
WS 2000 cfs
WS 1800 cfs
WS 1150 cfs
WS 600 cfs
WS 400 cfs
Ground
Levee
Bank Sta

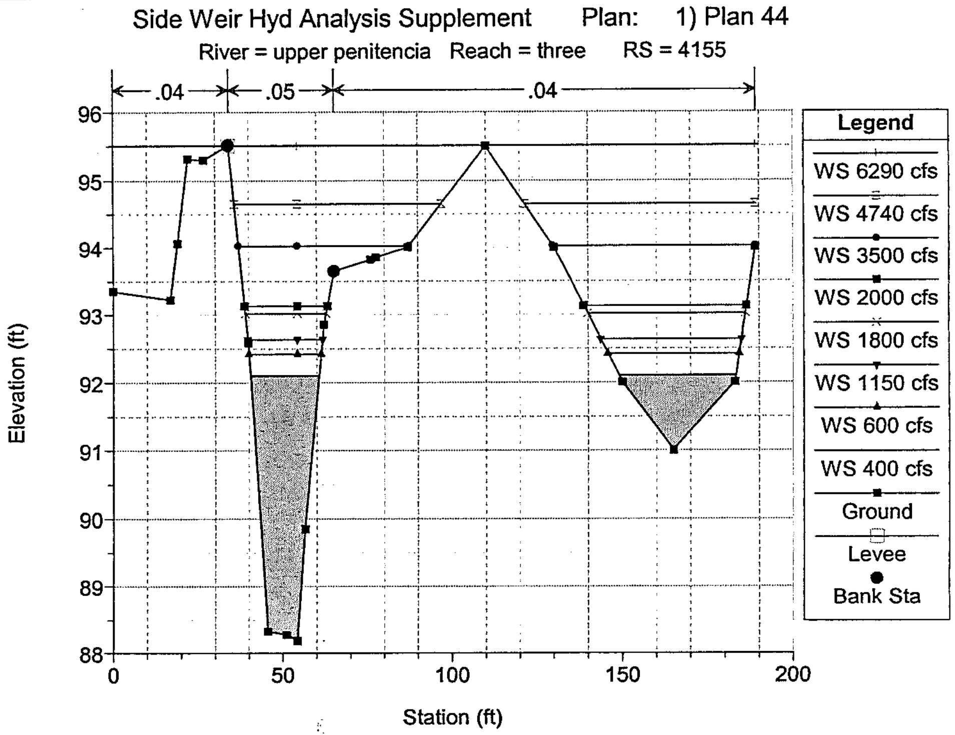

Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 4185
.04
.05
.04
Elevation (ft)
98
96
94
92
90
88
Station (ft)
0
50
100
150
200
250
Legend
WS 6290 cfs
WS 4740 cfs
WS 3500 cfs
WS 2000 cfs
WS 1800 cfs
WS 1150 cfs
WS 600 cfs
WS 400 cfs
Ground
Levee
Bank Sta


Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 4175
.04
.05
.04
Elevation (ft)
96
95
94
93
92
91
90
89
88
Station (ft)
0
50
100
150
200
Legend
WS 6290 cfs
WS 4740 cfs
WS 3500 cfs
WS 2000 cfs
WS 1800 cfs
WS 1150 cfs
WS 600 cfs
WS 400 cfs
Ground
Levee
Bank Sta



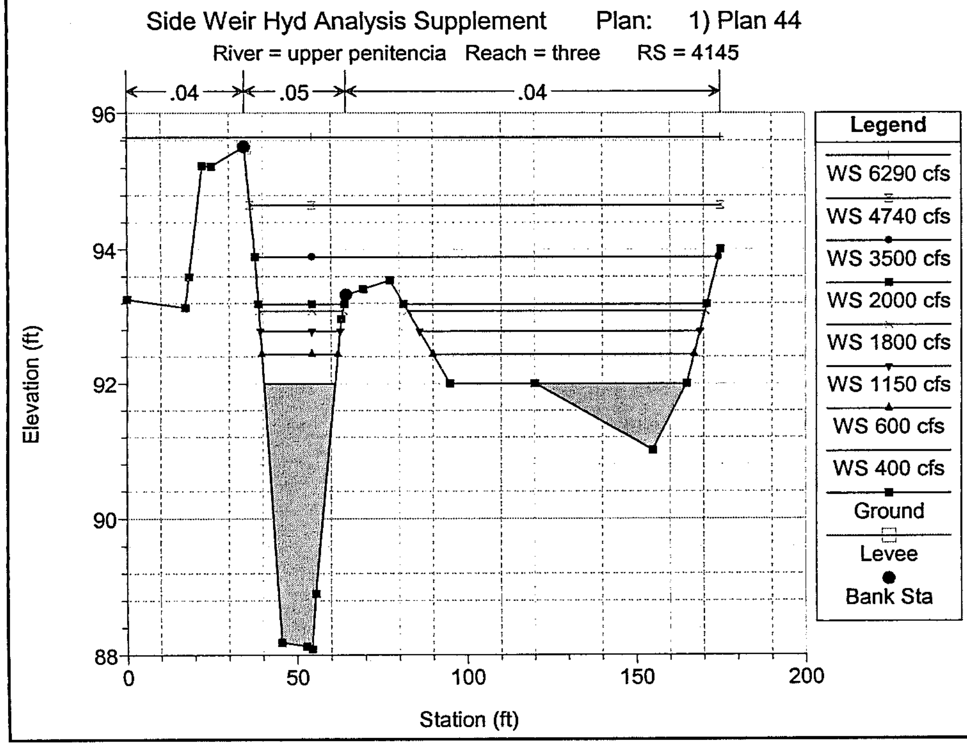
Side Weir Hyd Analysis Supplement Plan: 1) Plan 44

River = upper penitencia Reach = three RS = 4165



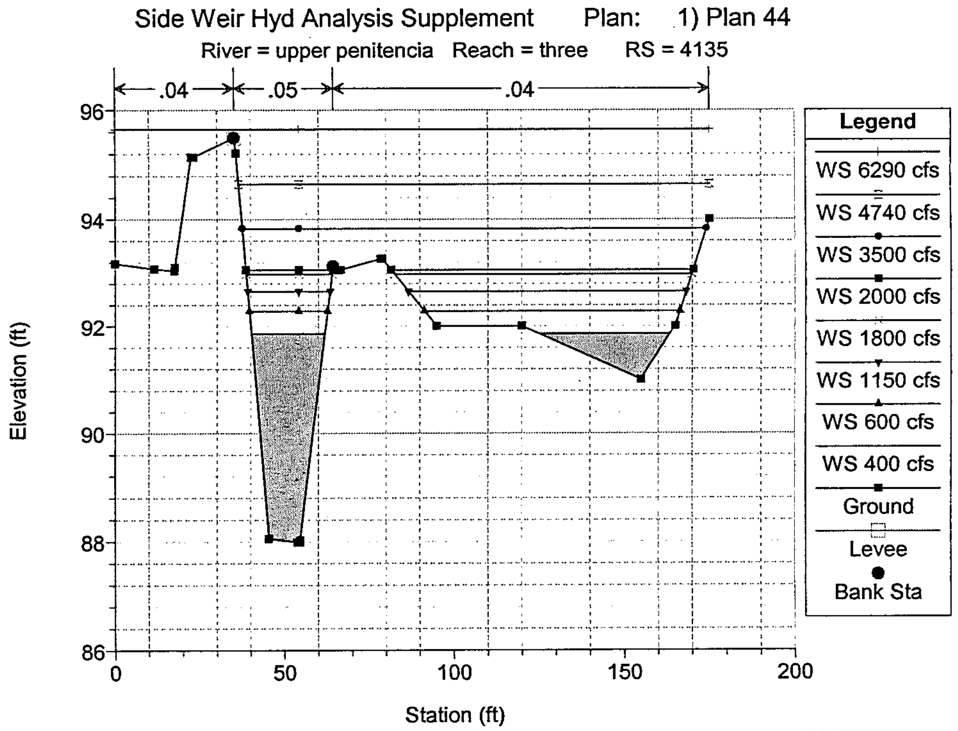
Side Weir Hyd Analysis Supplement Plan: 1) Plan 44

River = upper penitencia Reach = three RS = 4155



Side Weir Hyd Analysis Supplement Plan: 1) Plan 44

River = upper penitencia Reach = three RS = 4145

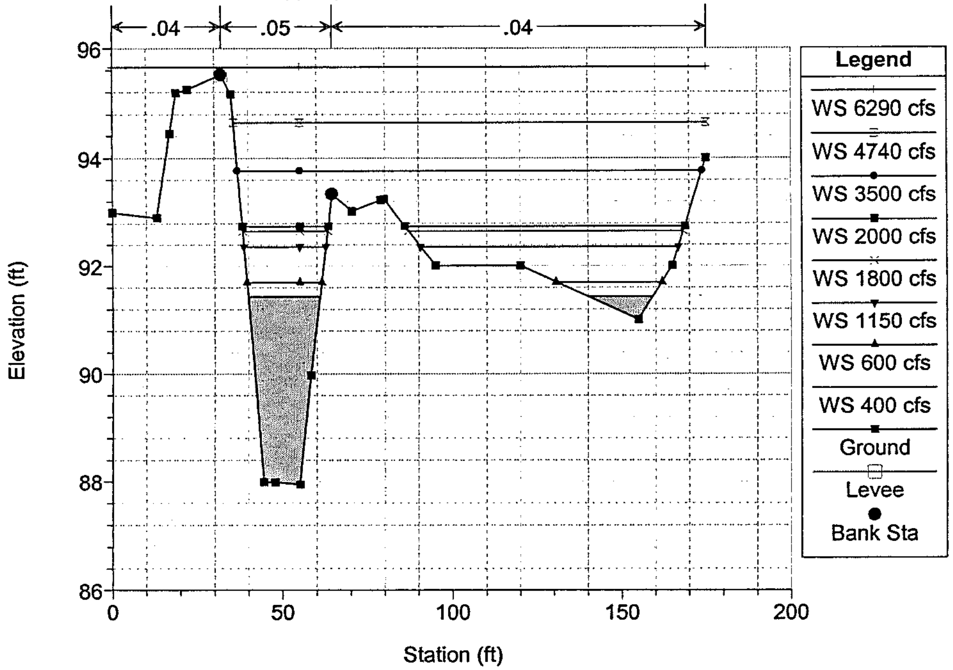


Side Weir Hyd Analysis Supplement Plan: 1) Plan 44

River = upper penitencia Reach = three RS = 4135

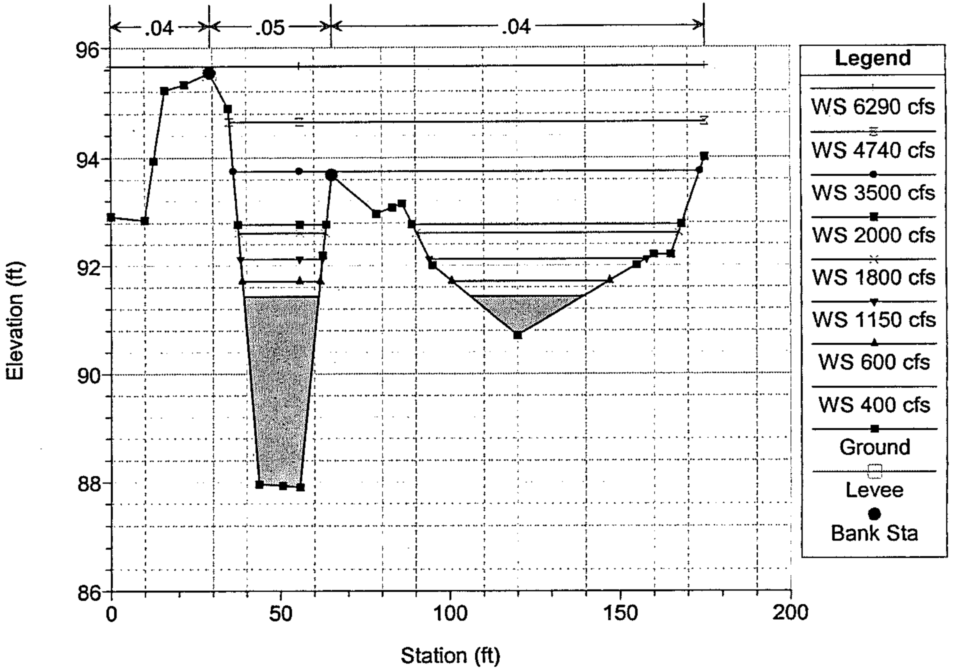
Side Weir Hyd Analysis Supplement Plan: 1) Plan 44

River = upper penitencia Reach = three RS = 4125



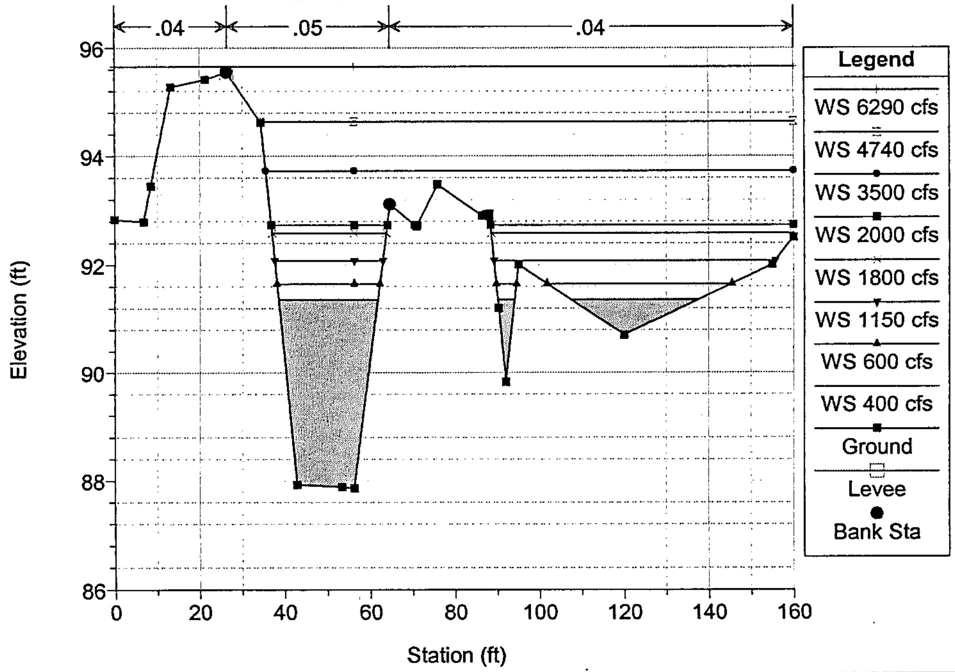
Side Weir Hyd Analysis Supplement Plan: 1) Plan 44

River = upper penitencia Reach = three RS = 4115



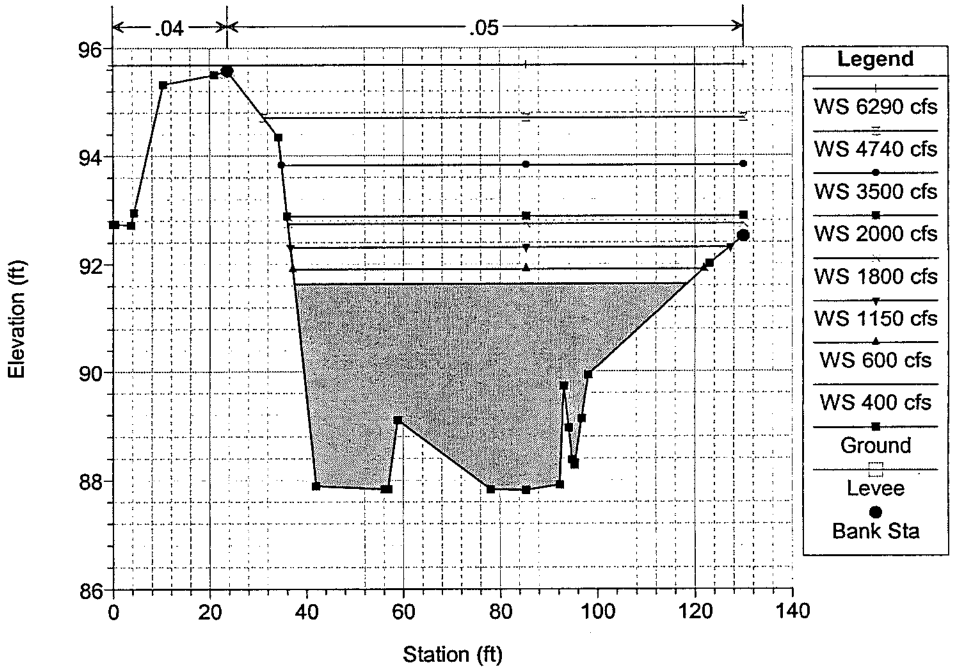
Side Weir Hyd Analysis Supplement Plan: 1) Plan 44

River = upper penitencia Reach = three RS = 4105

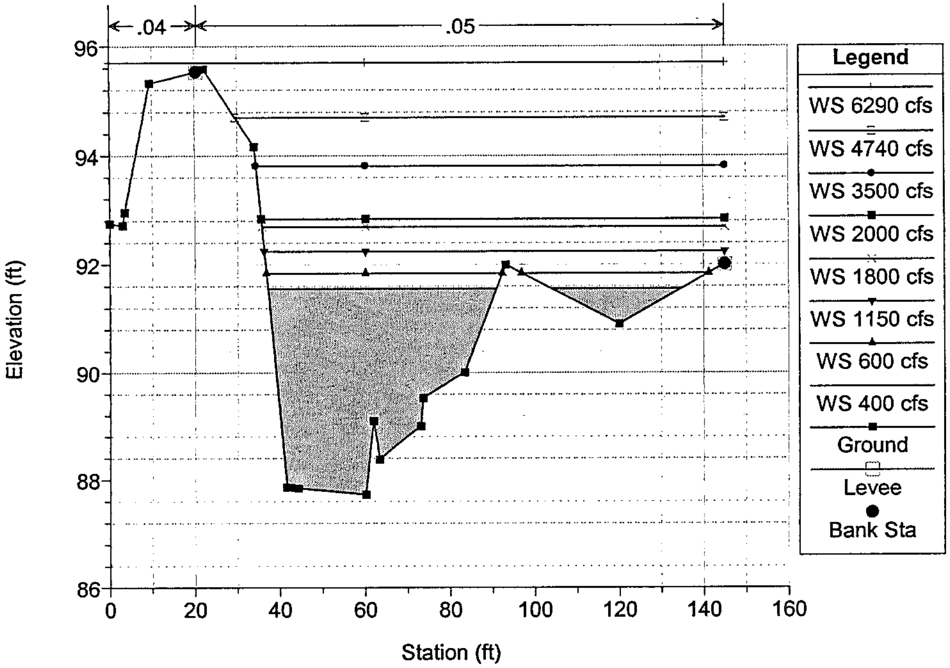


Side Weir Hyd Analysis Supplement Plan: 1) Plan 44

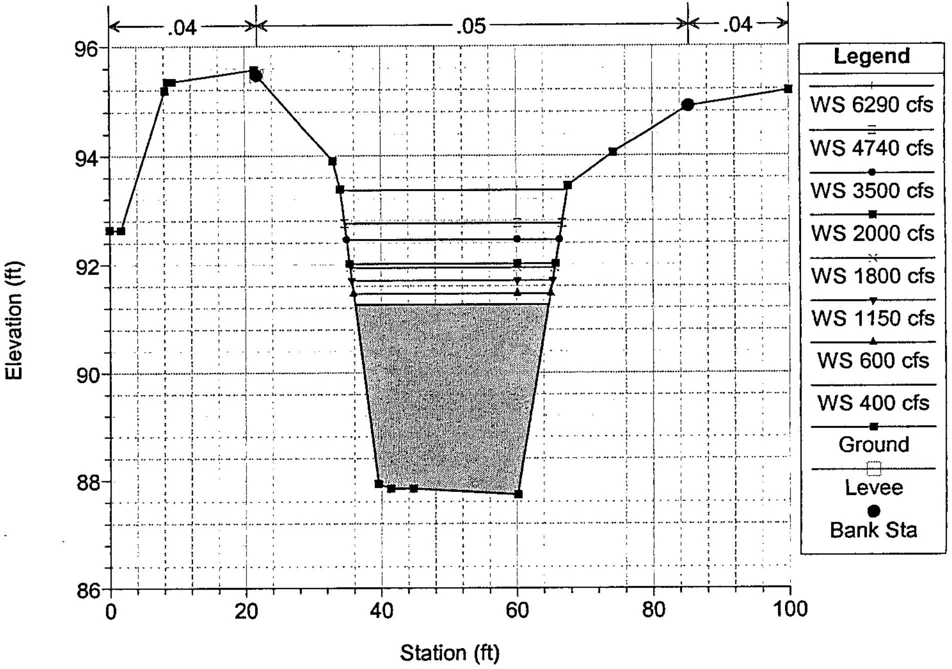
River = upper penitencia Reach = three RS = 4095



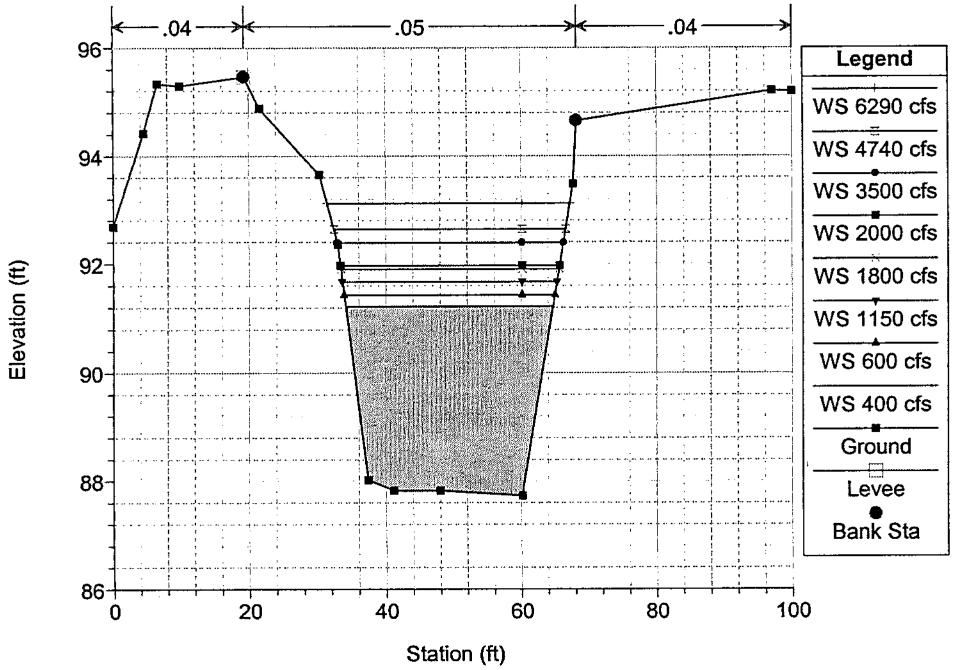
Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 4085



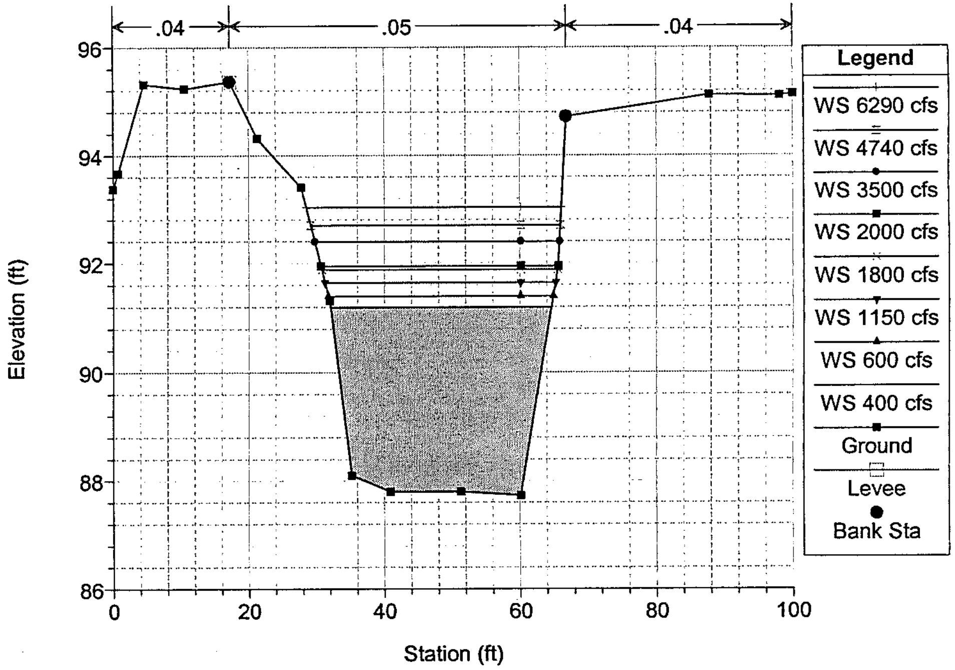
Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 4075

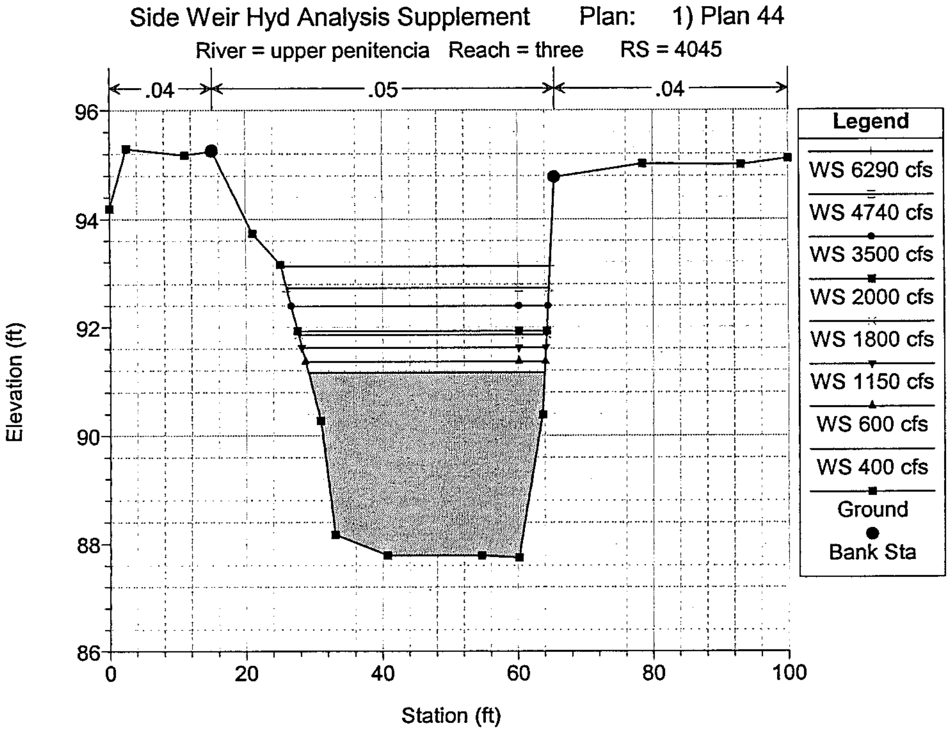


Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 4065

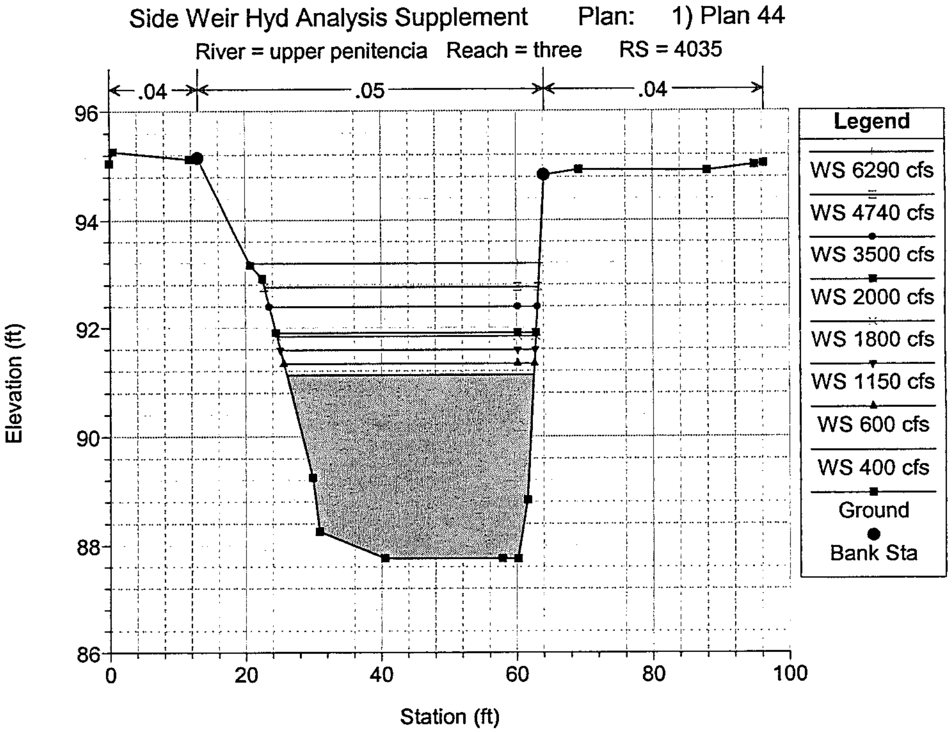


Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 4055

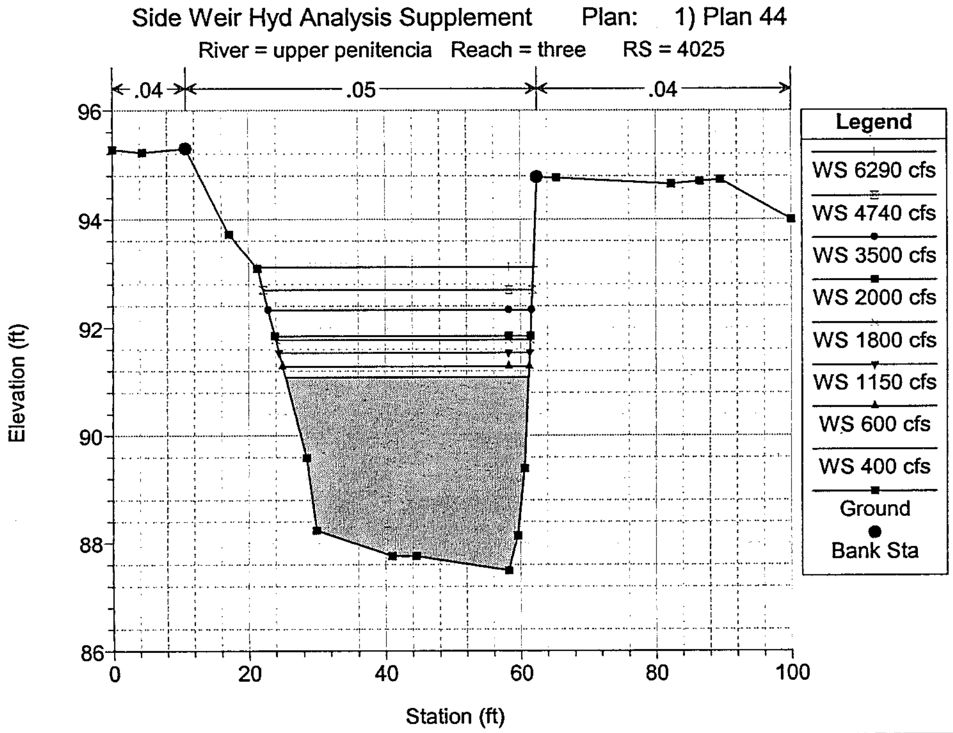



Side Weir Hyd Analysis Supplement Plan: 1) Plan 44

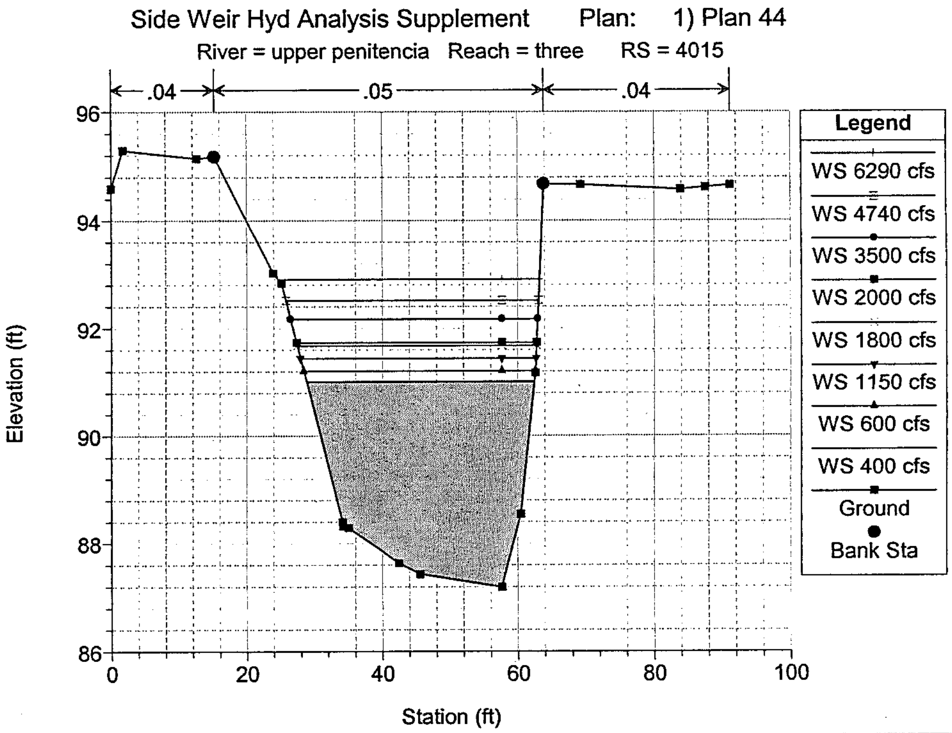
River = upper penitencia Reach = three RS = 4045


Side Weir Hyd Analysis Supplement Plan: 1) Plan 44

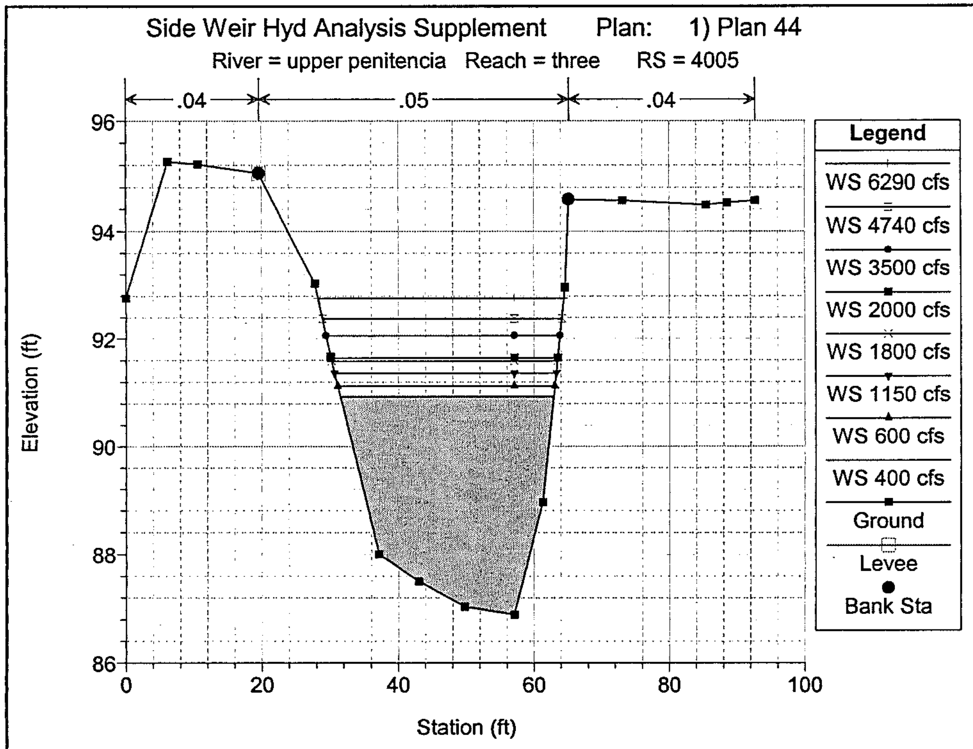
River = upper penitencia Reach = three RS = 4035

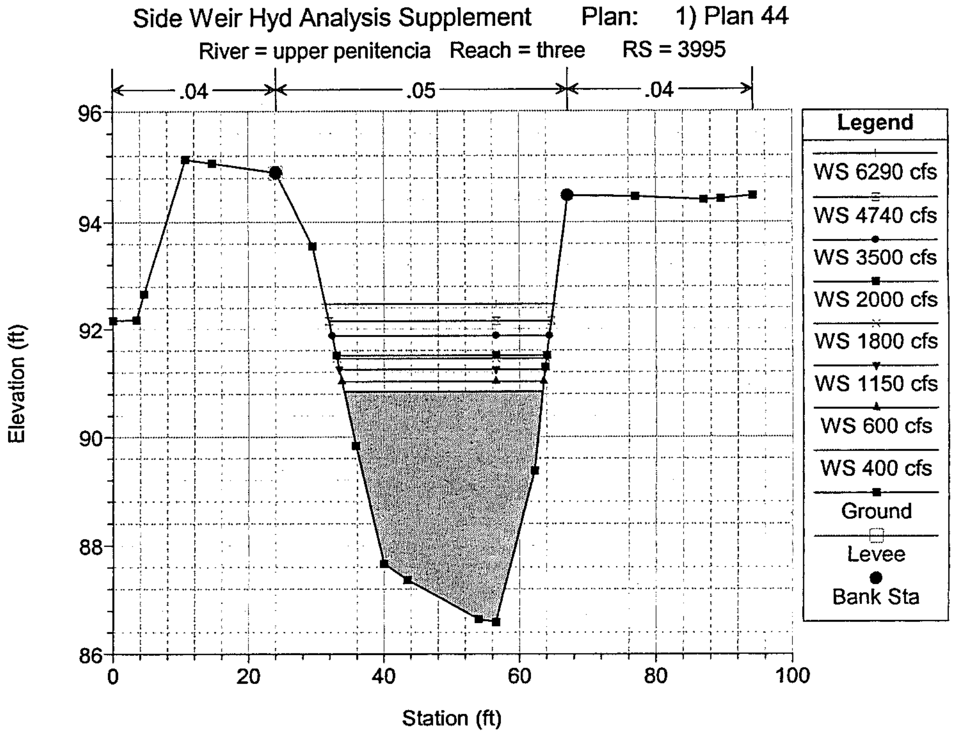

Side Weir Hyd Analysis Supplement Plan: 1) Plan 44

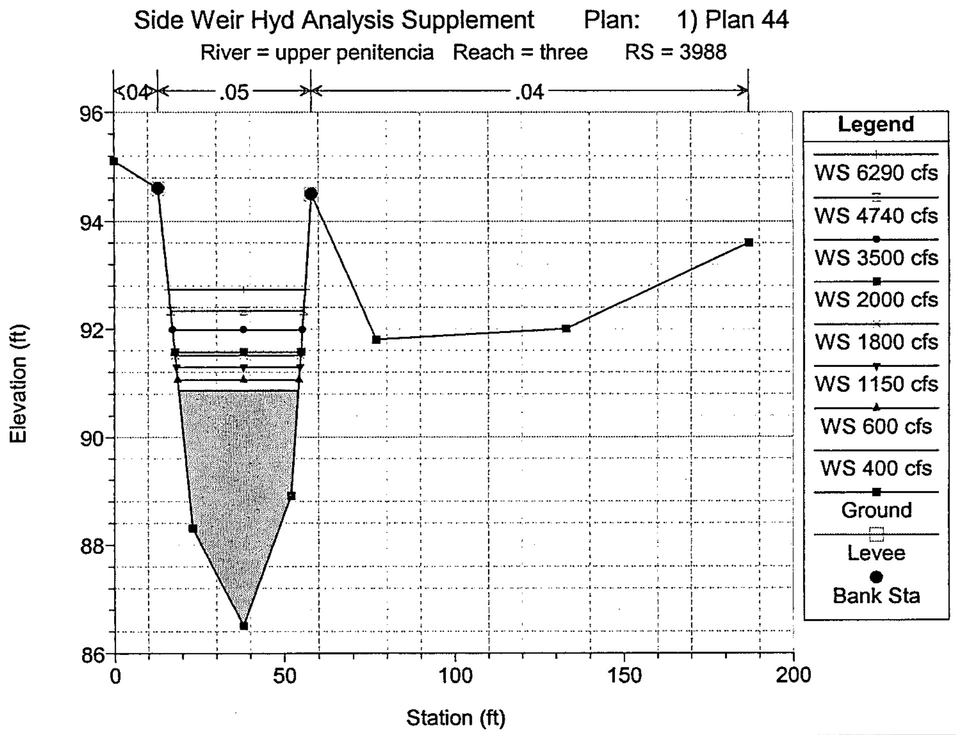
River = upper penitencia Reach = three RS = 4025

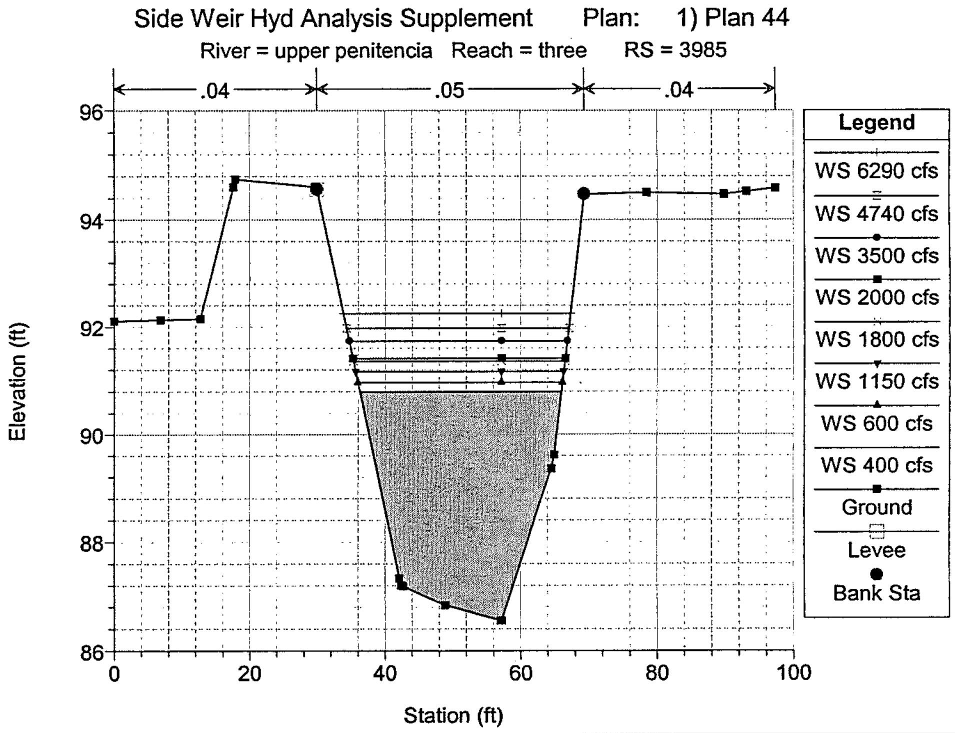

Side Weir Hyd Analysis Supplement Plan: 1) Plan 44

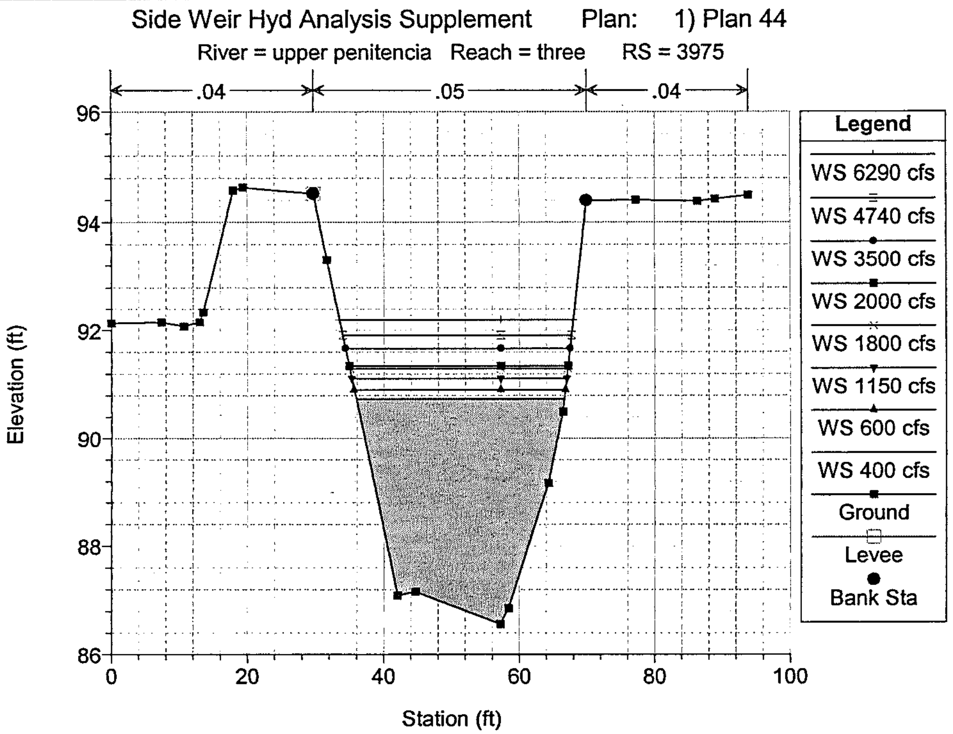
River = upper penitencia Reach = three RS = 4015

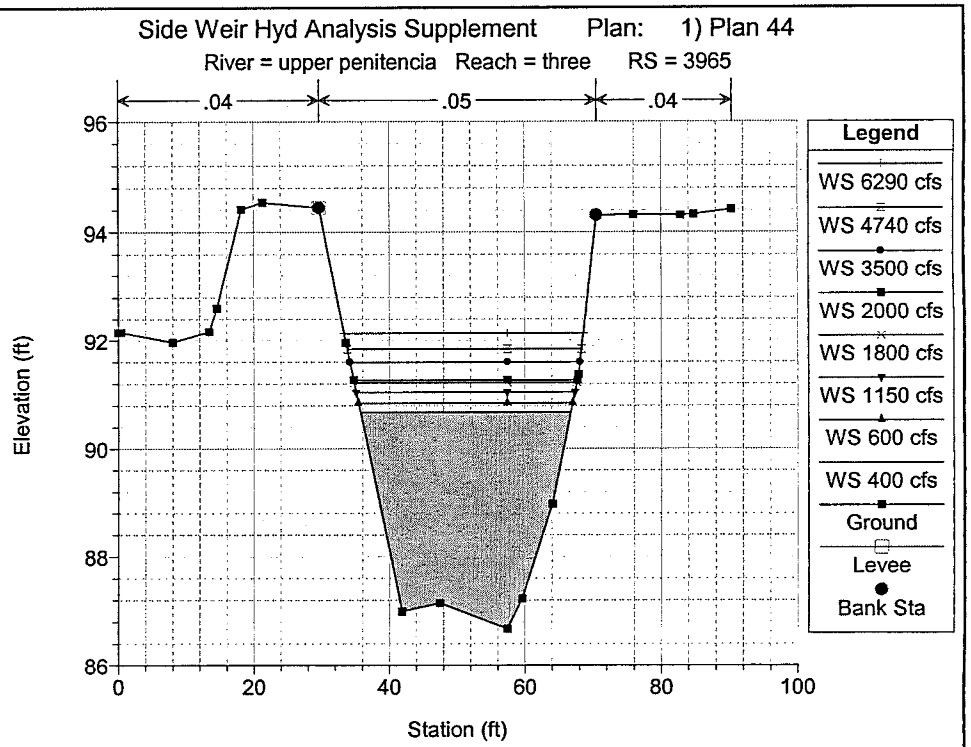

Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 4005
.04
.05
.04
Elevation (ft)
Station (ft)
96
94
92
90
88
86
0
20
40
60
80
100
Legend
WS 6290 cfs
WS 4740 cfs
WS 3500 cfs
WS 2000 cfs
WS 1800 cfs
WS 1150 cfs
WS 600 cfs
WS 400 cfs
Ground
Levee
Bank Sta

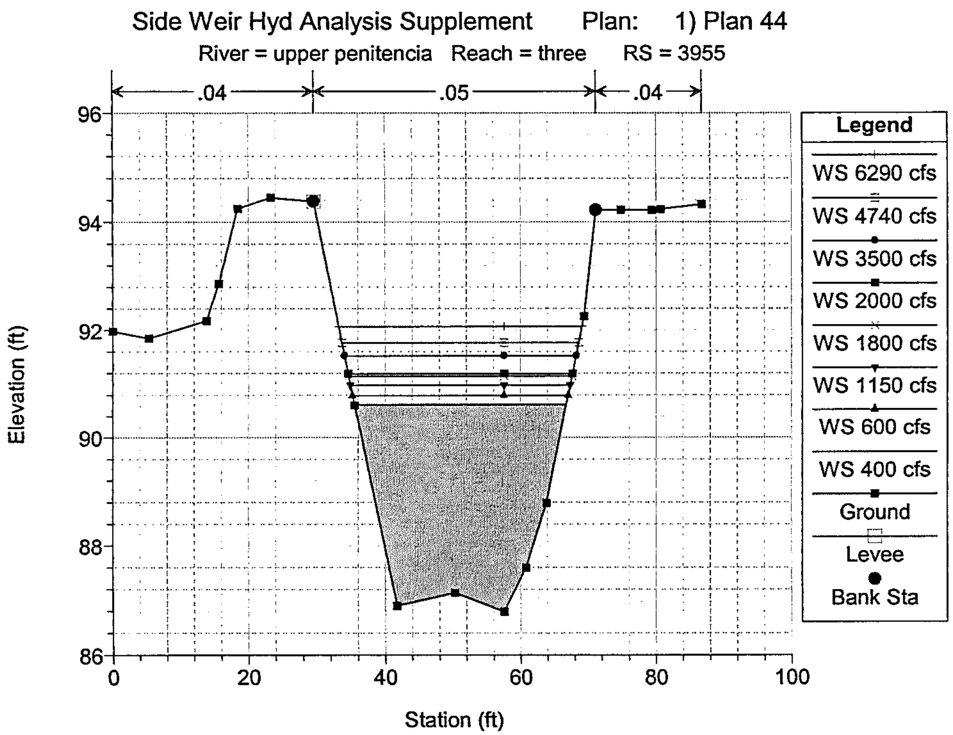

Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 3995
.04
.05
.04
Elevation (ft)
Station (ft)
96
94
92
90
88
86
0
20
40
60
80
100
Legend
WS 6290 cfs
WS 4740 cfs
WS 3500 cfs
WS 2000 cfs
WS 1800 cfs
WS 1150 cfs
WS 600 cfs
WS 400 cfs
Ground
Levee
Bank Sta

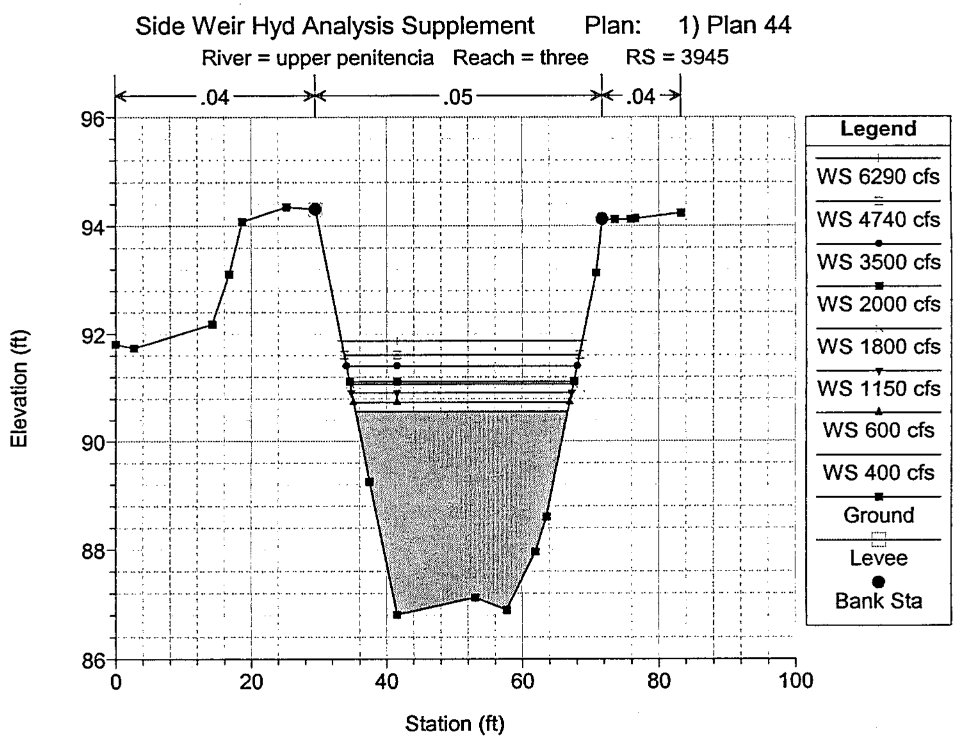

Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 3988
.04
.05
.04
Elevation (ft)
Station (ft)
96
94
92
90
88
86
0
50
100
150
200
Legend
WS 6290 cfs
WS 4740 cfs
WS 3500 cfs
WS 2000 cfs
WS 1800 cfs
WS 1150 cfs
WS 600 cfs
WS 400 cfs
Ground
Levee
Bank Sta

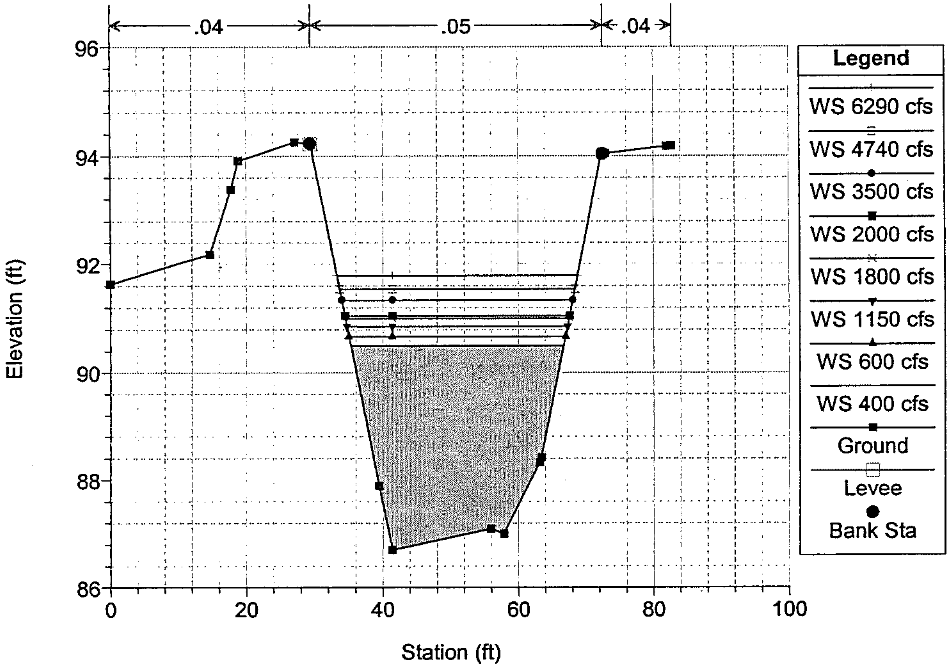

Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 3985
.04
.05
.04
Elevation (ft)
Station (ft)
96
94
92
90
88
86
0
20
40
60
80
100
Legend
WS 6290 cfs
WS 4740 cfs
WS 3500 cfs
WS 2000 cfs
WS 1800 cfs
WS 1150 cfs
WS 600 cfs
WS 400 cfs
Ground
Levee
Bank Sta


Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 3975
.04
.05
.04
Legend
WS 6290 cfs
WS 4740 cfs
WS 3500 cfs
WS 2000 cfs
WS 1800 cfs
WS 1150 cfs
WS 600 cfs
WS 400 cfs
Ground
Levee
Bank Sta
Elevation (ft)
96
94
92
90
88
86
Station (ft)
0
20
40
60
80
100


Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 3965
.04
.05
.04
Legend
WS 6290 cfs
WS 4740 cfs
WS 3500 cfs
WS 2000 cfs
WS 1800 cfs
WS 1150 cfs
WS 600 cfs
WS 400 cfs
Ground
Levee
Bank Sta
Elevation (ft)
96
94
92
90
88
86
Station (ft)
0
20
40
60
80
100

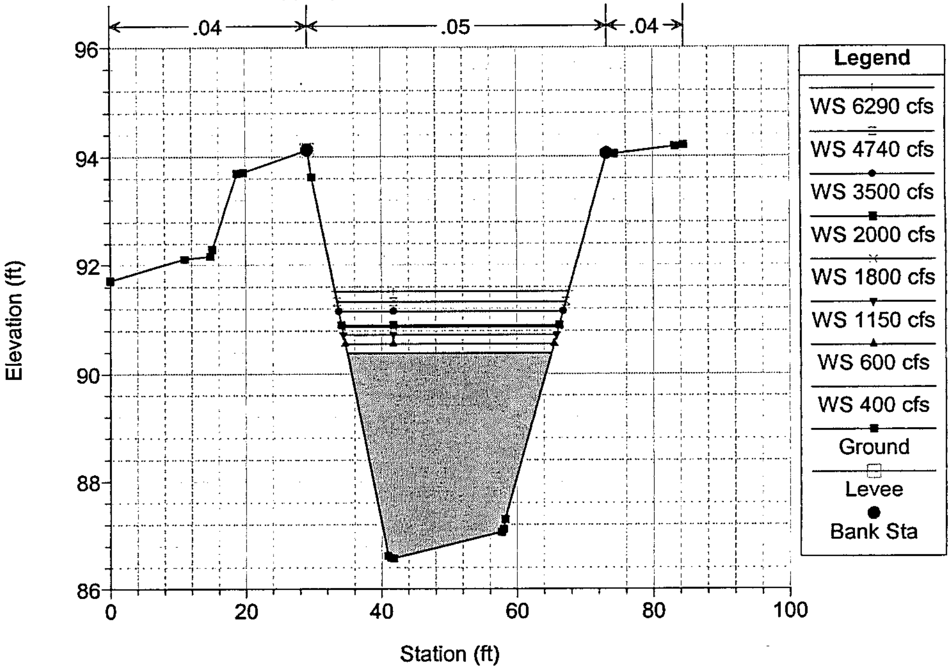

Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 3955
.04
.05
.04
Legend
WS 6290 cfs
WS 4740 cfs
WS 3500 cfs
WS 2000 cfs
WS 1800 cfs
WS 1150 cfs
WS 600 cfs
WS 400 cfs
Ground
Levee
Bank Sta
Elevation (ft)
96
94
92
90
88
86
Station (ft)
0
20
40
60
80
100


Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 3945
.04
.05
.04
Legend
WS 6290 cfs
WS 4740 cfs
WS 3500 cfs
WS 2000 cfs
WS 1800 cfs
WS 1150 cfs
WS 600 cfs
WS 400 cfs
Ground
Levee
Bank Sta
Elevation (ft)
96
94
92
90
88
86
Station (ft)
0
20
40
60
80
100



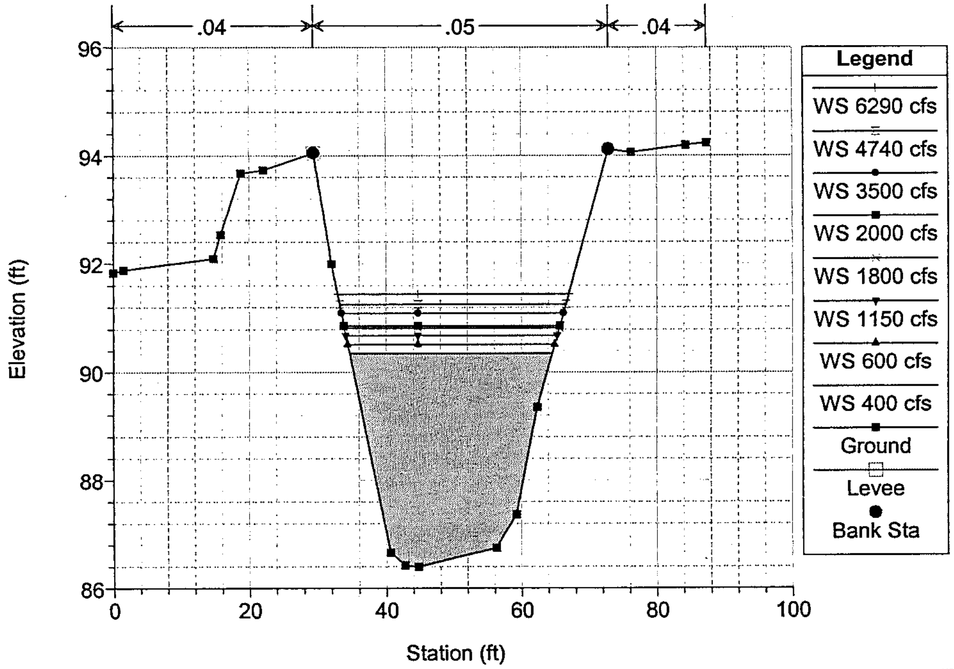
Side Weir Hyd Analysis Supplement Plan: 1) Plan 44

River = upper penitencia Reach = three RS = 3935



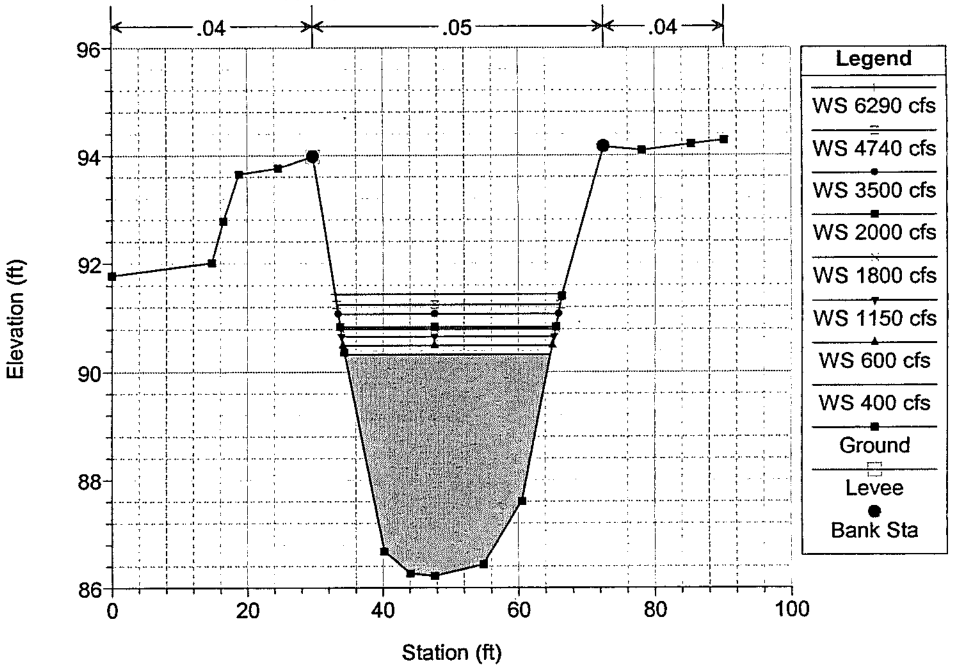
Side Weir Hyd Analysis Supplement Plan: 1) Plan 44

River = upper penitencia Reach = three RS = 3925



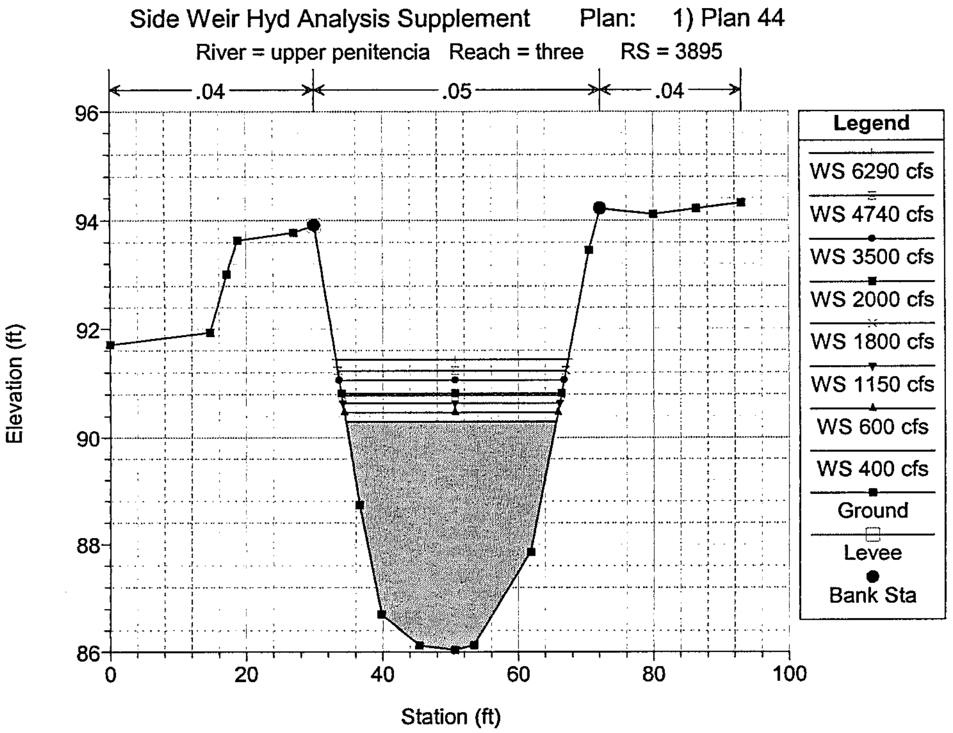
Side Weir Hyd Analysis Supplement Plan: 1) Plan 44

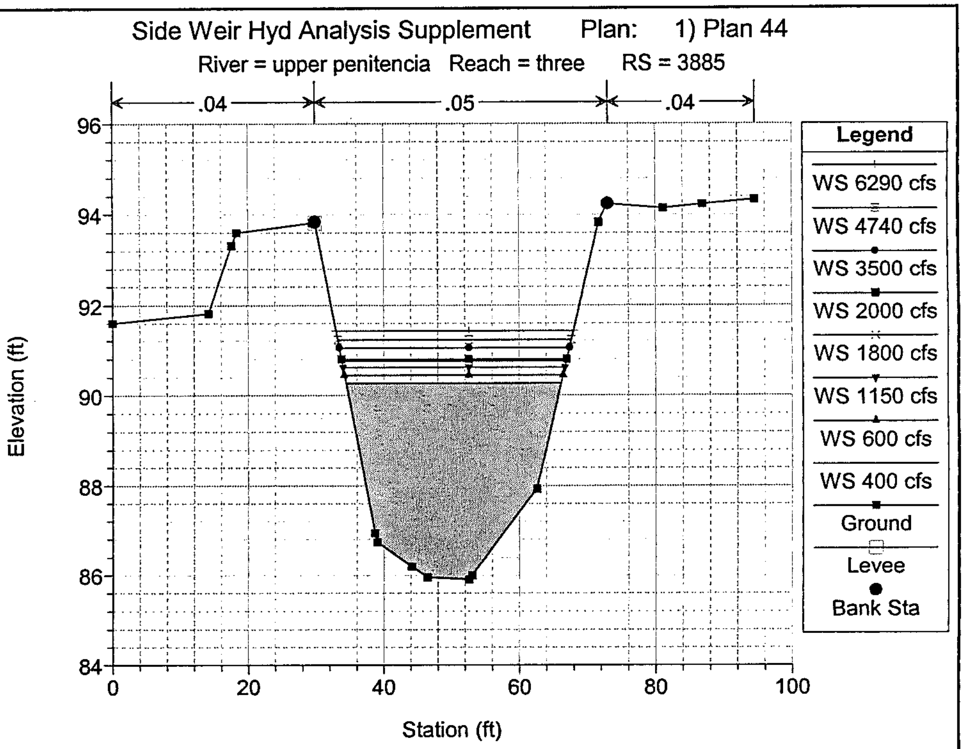
River = upper penitencia Reach = three RS = 3915

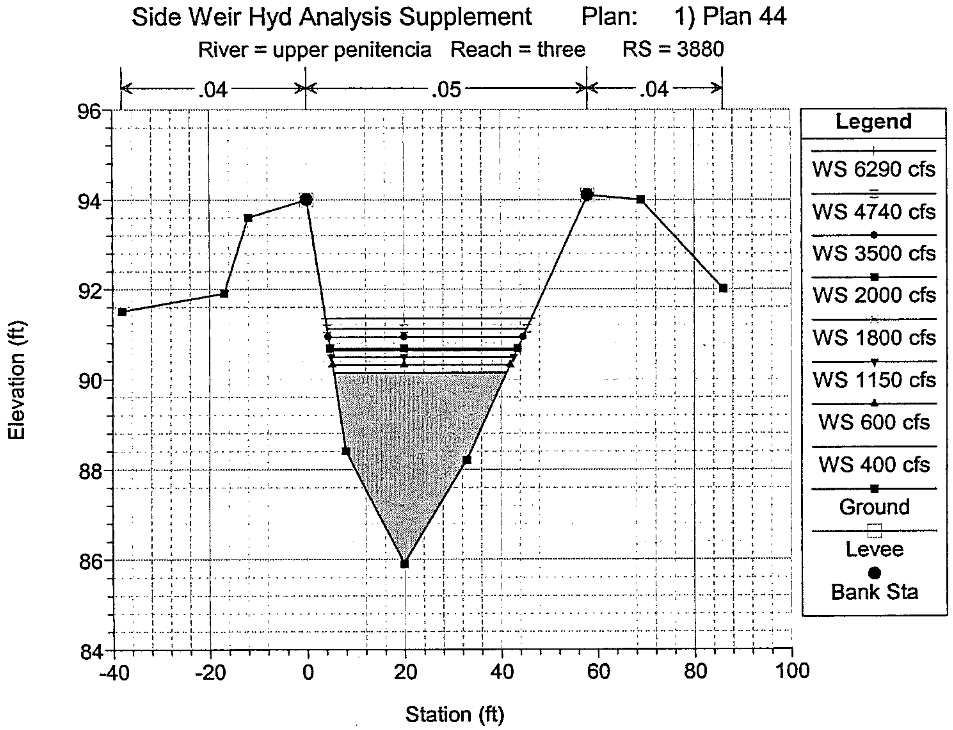


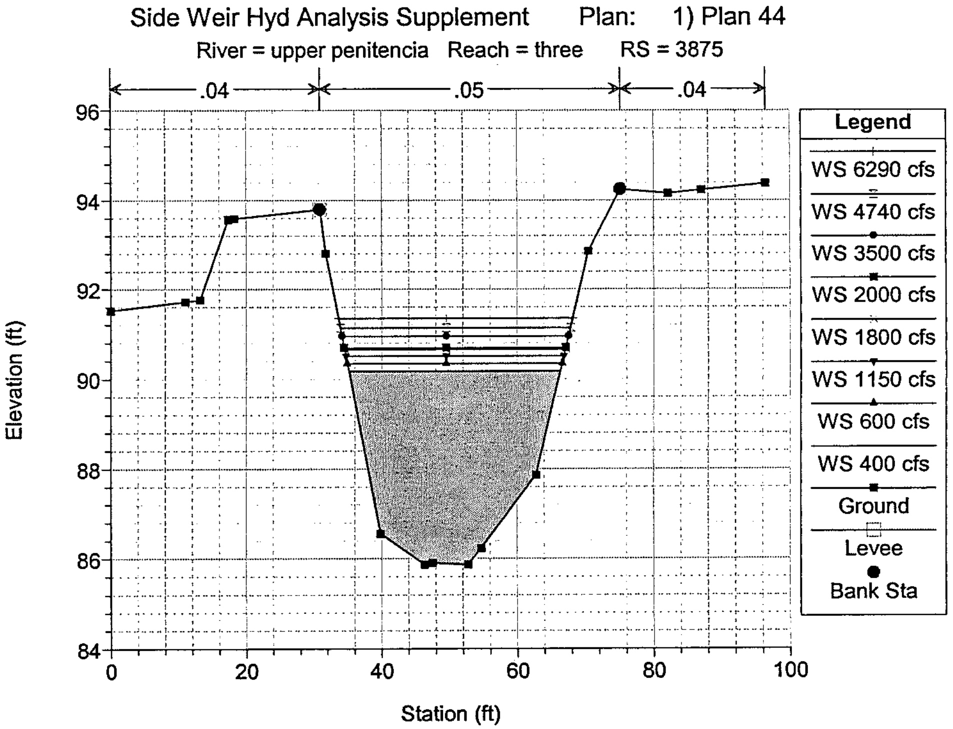
Side Weir Hyd Analysis Supplement Plan: 1) Plan 44

River = upper penitencia Reach = three RS = 3905

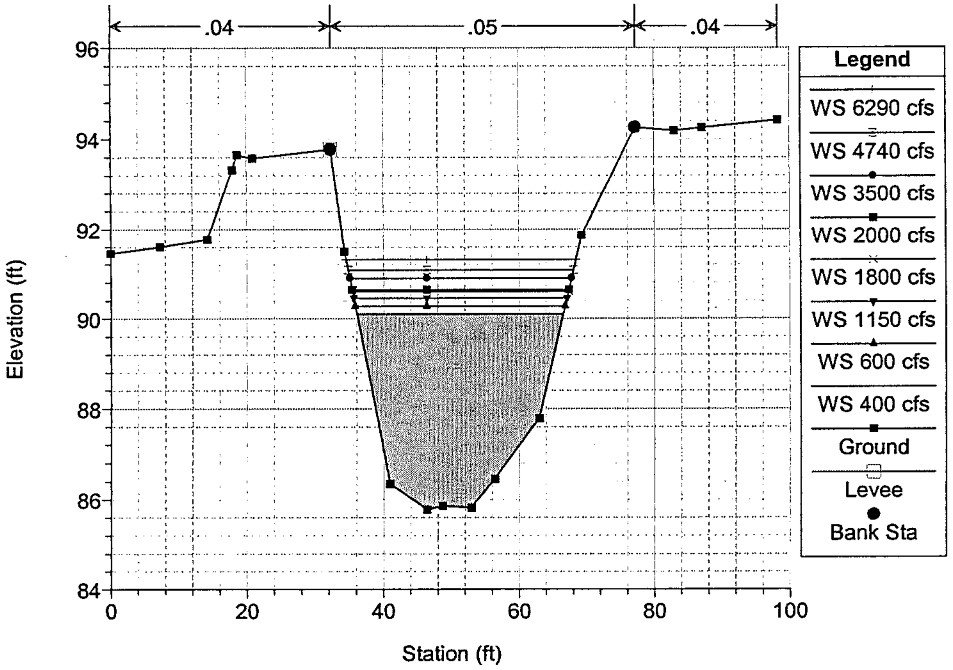

Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 3895
.04
.05
.04
Elevation (ft)
96
94
92
90
88
86
0
20
40
60
80
100
Station (ft)
Legend
WS 6290 cfs
WS 4740 cfs
WS 3500 cfs
WS 2000 cfs
WS 1800 cfs
WS 1150 cfs
WS 600 cfs
WS 400 cfs
Ground
Levee
Bank Sta


Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 3885
.04
.05
.04
Elevation (ft)
96
94
92
90
88
86
84
0
20
40
60
80
100
Station (ft)
Legend
WS 6290 cfs
WS 4740 cfs
WS 3500 cfs
WS 2000 cfs
WS 1800 cfs
WS 1150 cfs
WS 600 cfs
WS 400 cfs
Ground
Levee
Bank Sta

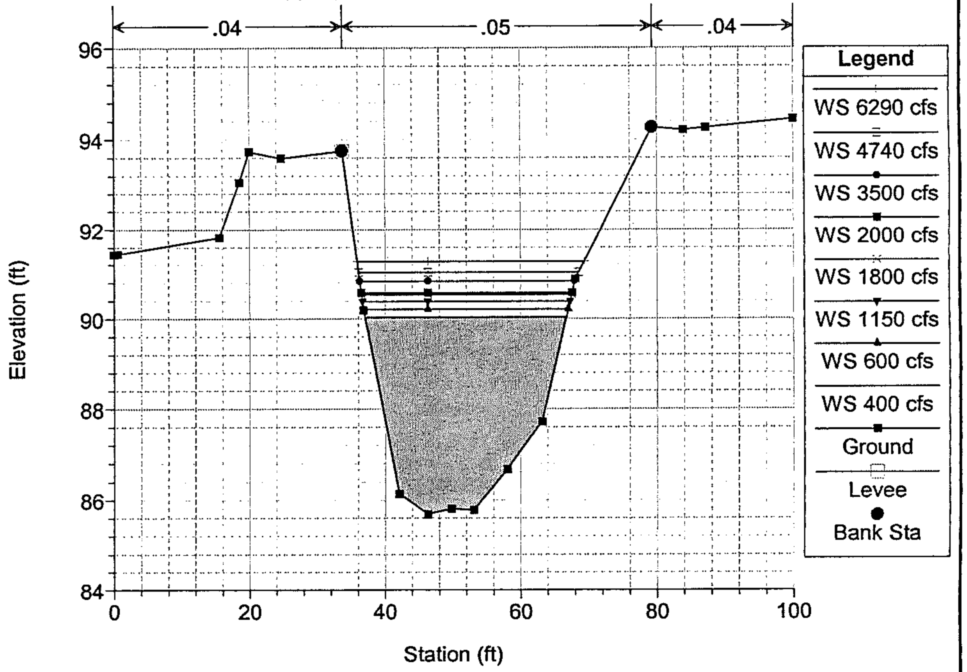

Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 3880
.04
.05
.04
Elevation (ft)
96
94
92
90
88
86
84
-40
-20
0
20
40
60
80
100
Station (ft)
Legend
WS 6290 cfs
WS 4740 cfs
WS 3500 cfs
WS 2000 cfs
WS 1800 cfs
WS 1150 cfs
WS 600 cfs
WS 400 cfs
Ground
Levee
Bank Sta


Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 3875
.04
.05
.04
Elevation (ft)
96
94
92
90
88
86
84
0
20
40
60
80
100
Station (ft)
Legend
WS 6290 cfs
WS 4740 cfs
WS 3500 cfs
WS 2000 cfs
WS 1800 cfs
WS 1150 cfs
WS 600 cfs
WS 400 cfs
Ground
Levee
Bank Sta

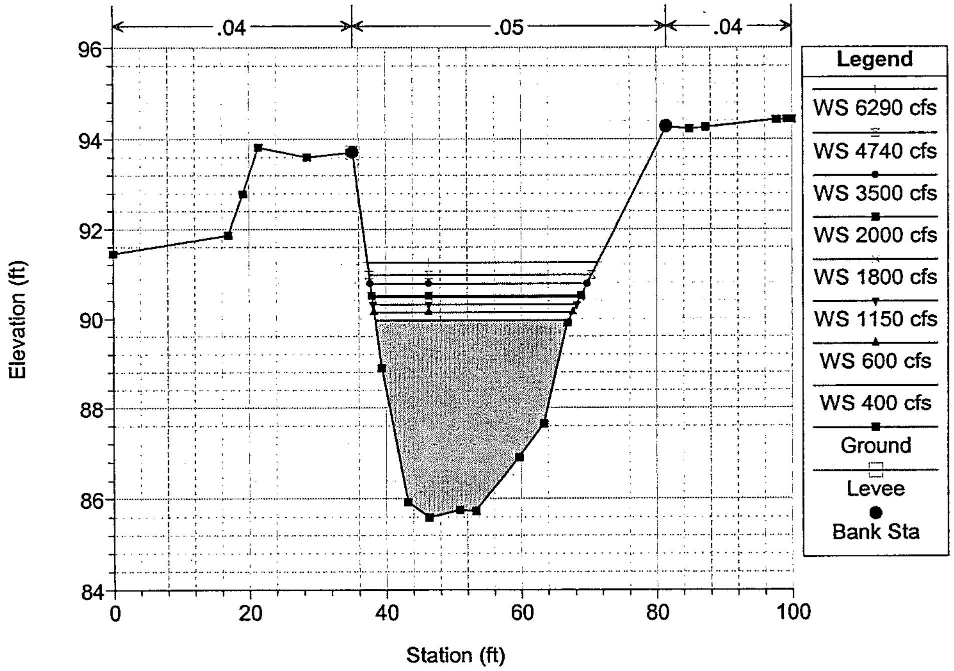
Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 3865



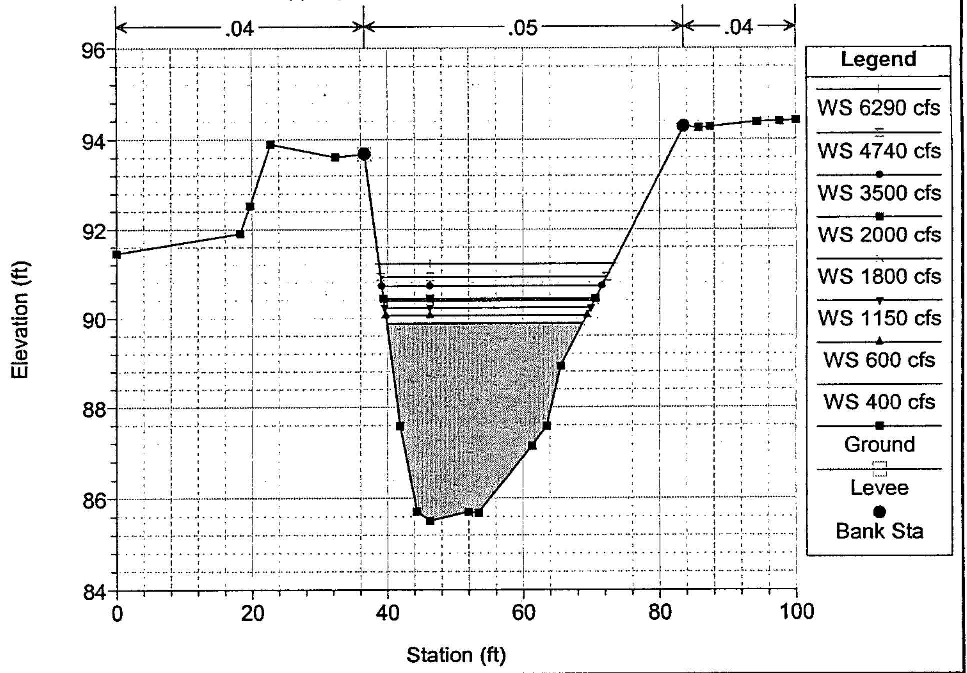
Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 3855

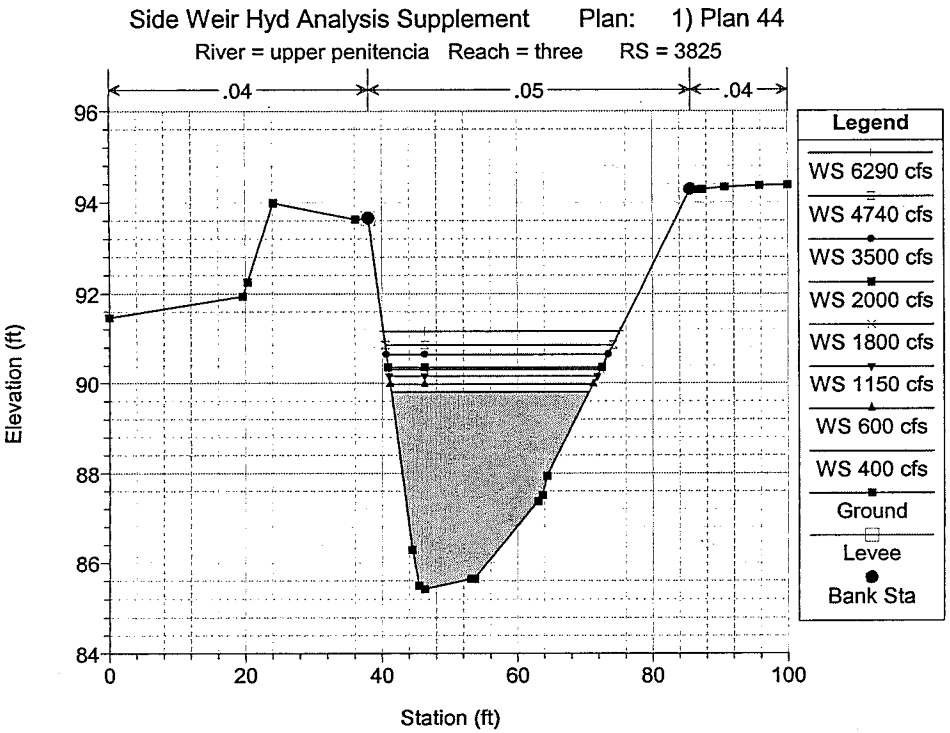


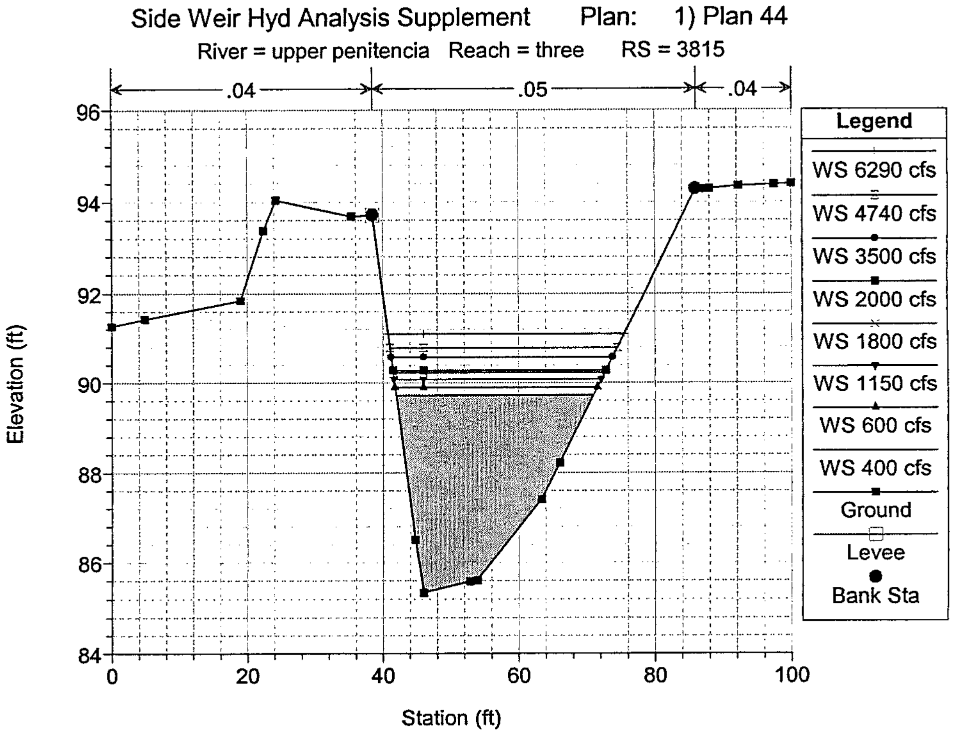
Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 3845

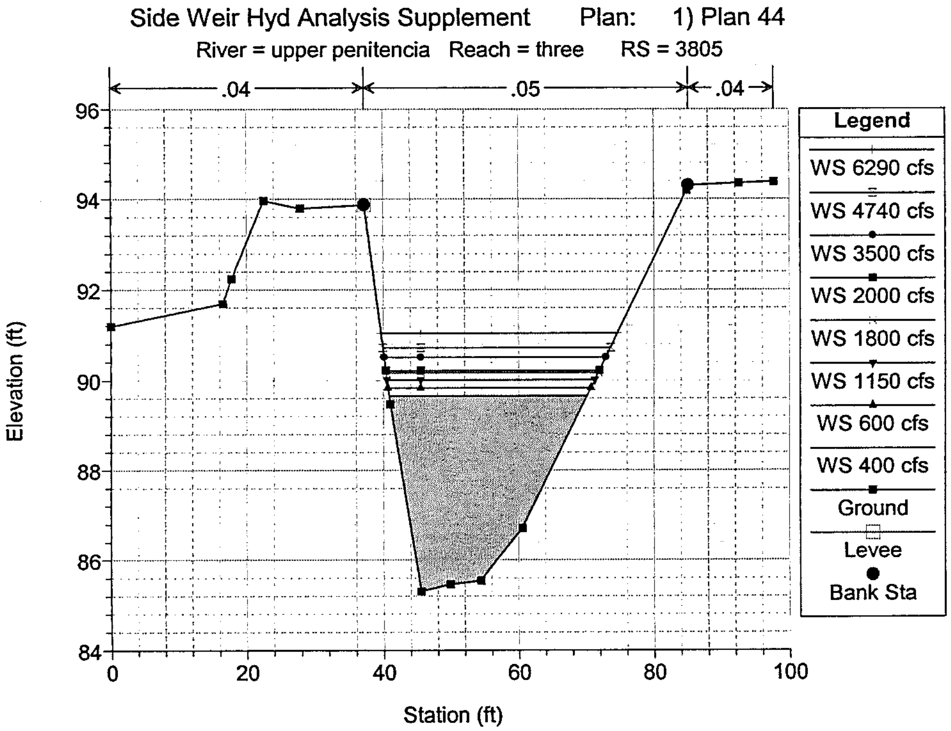


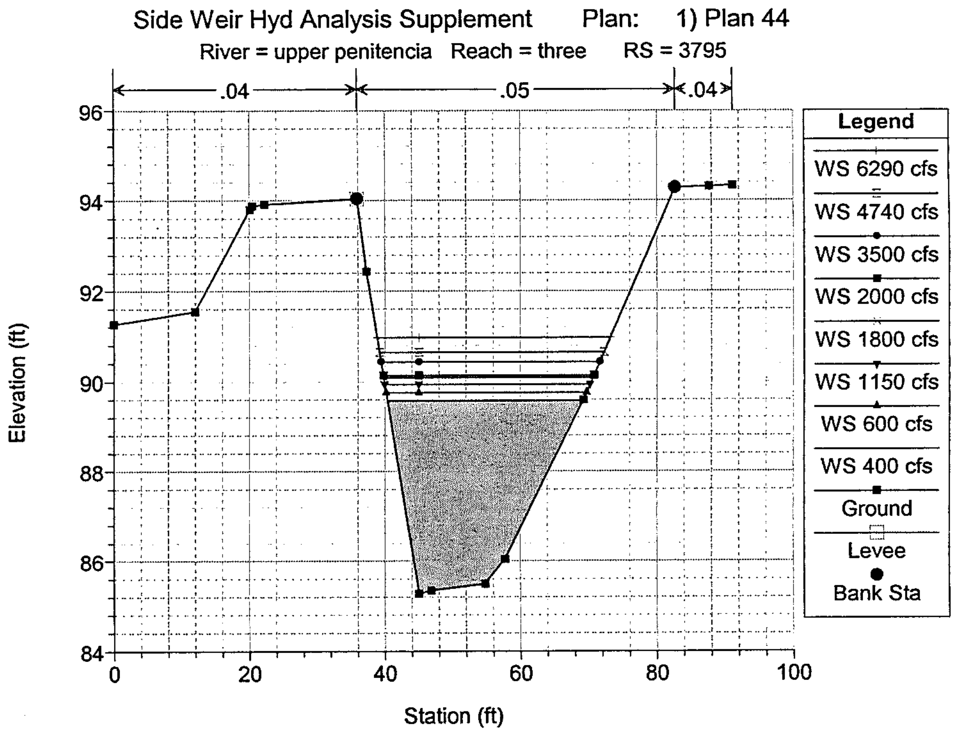
Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 3835

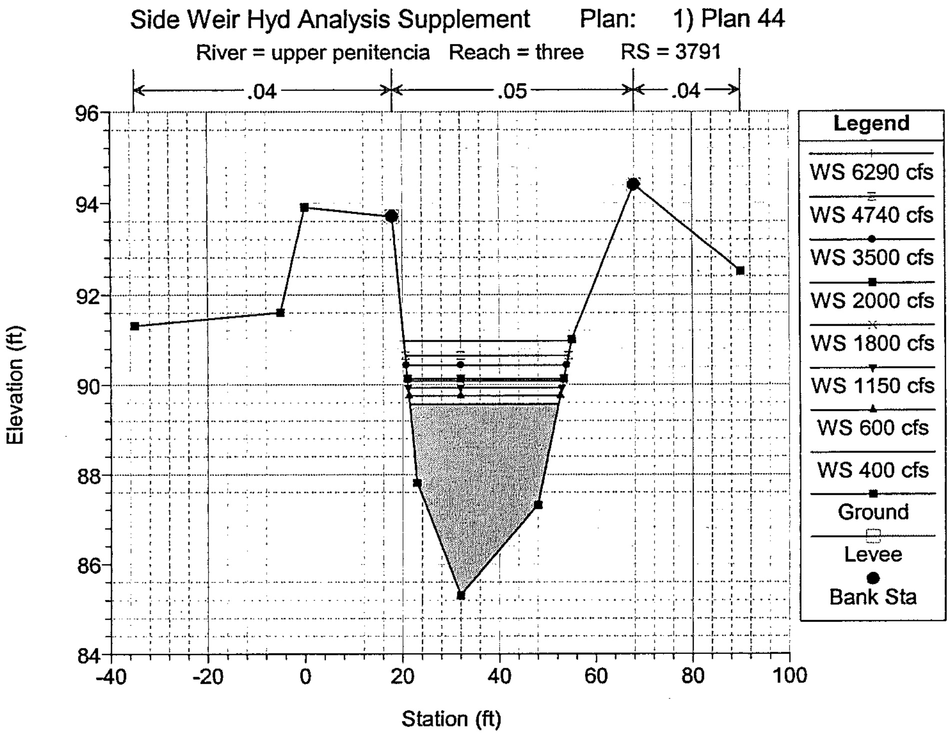


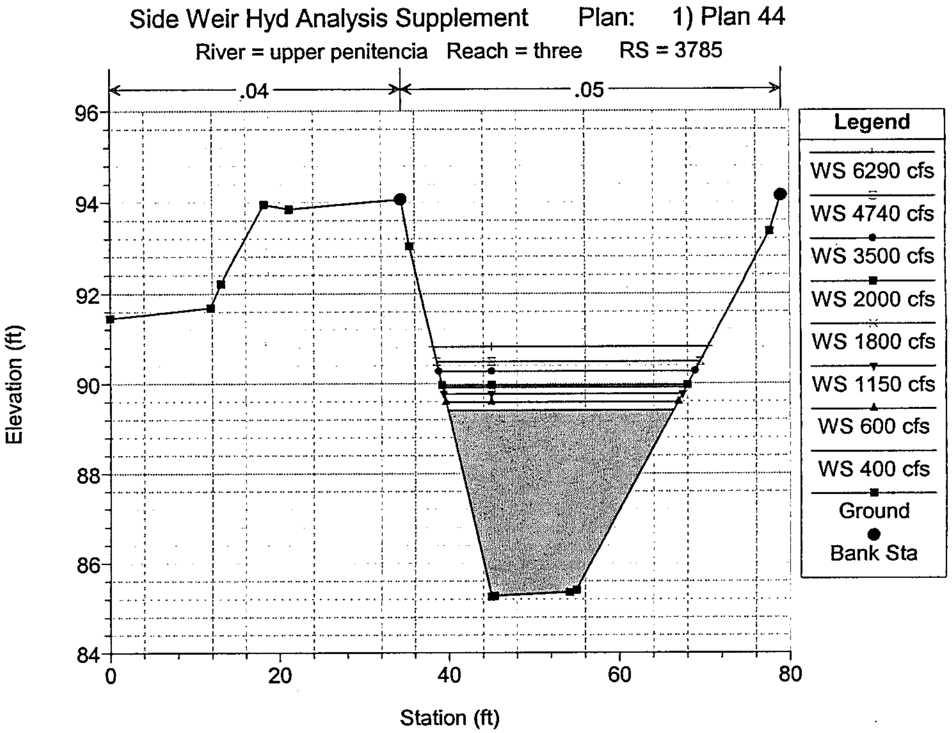

Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 3825

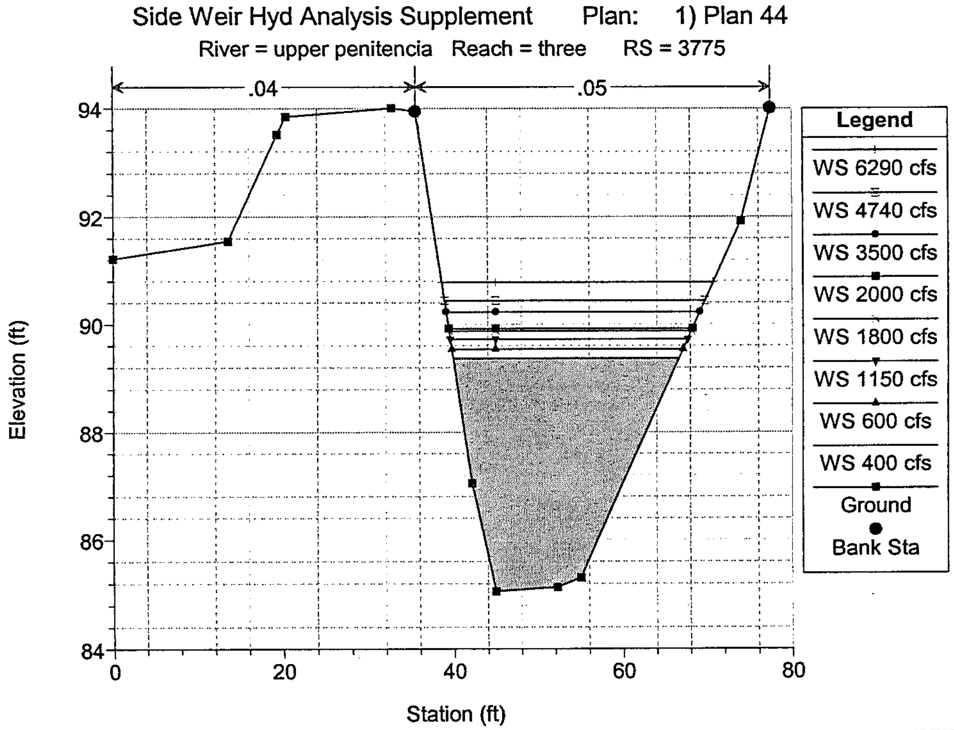

Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 3815

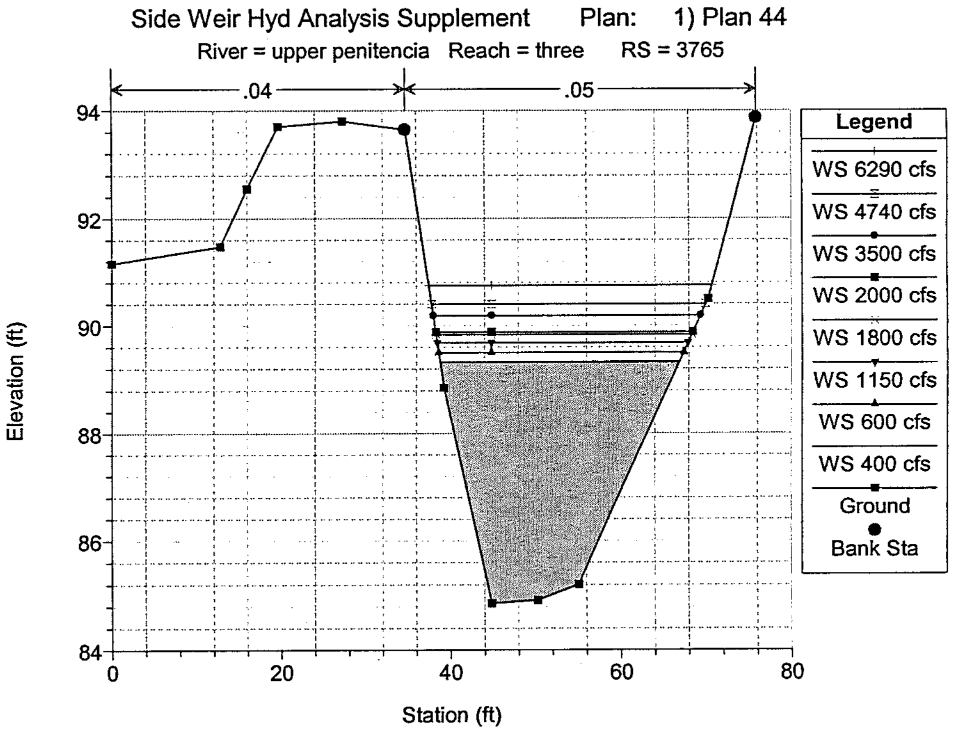

Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 3805

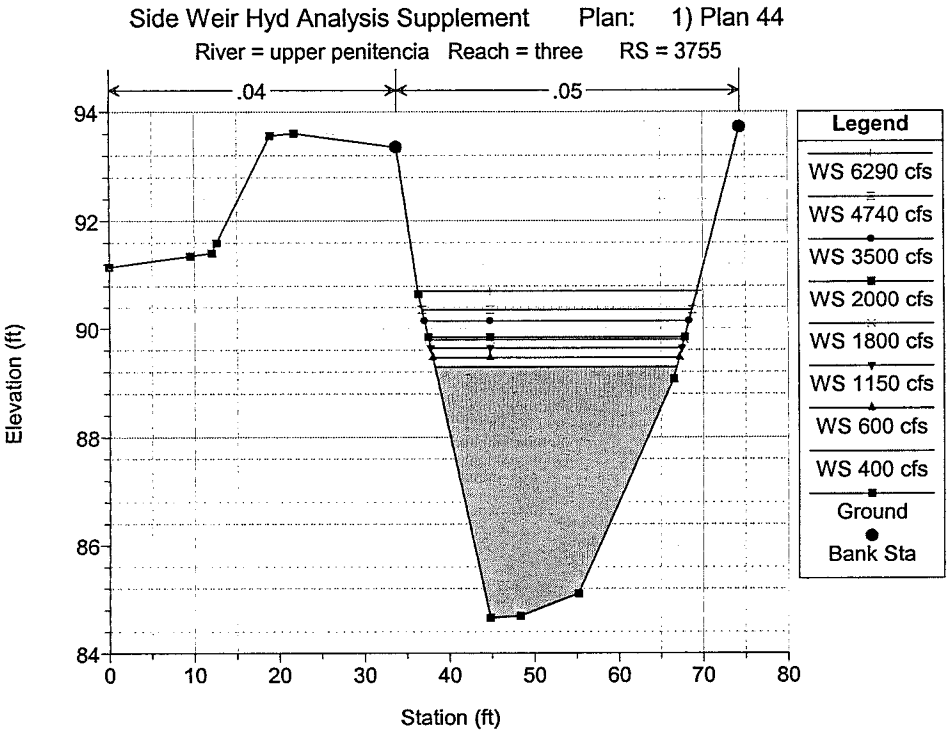

Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 3795

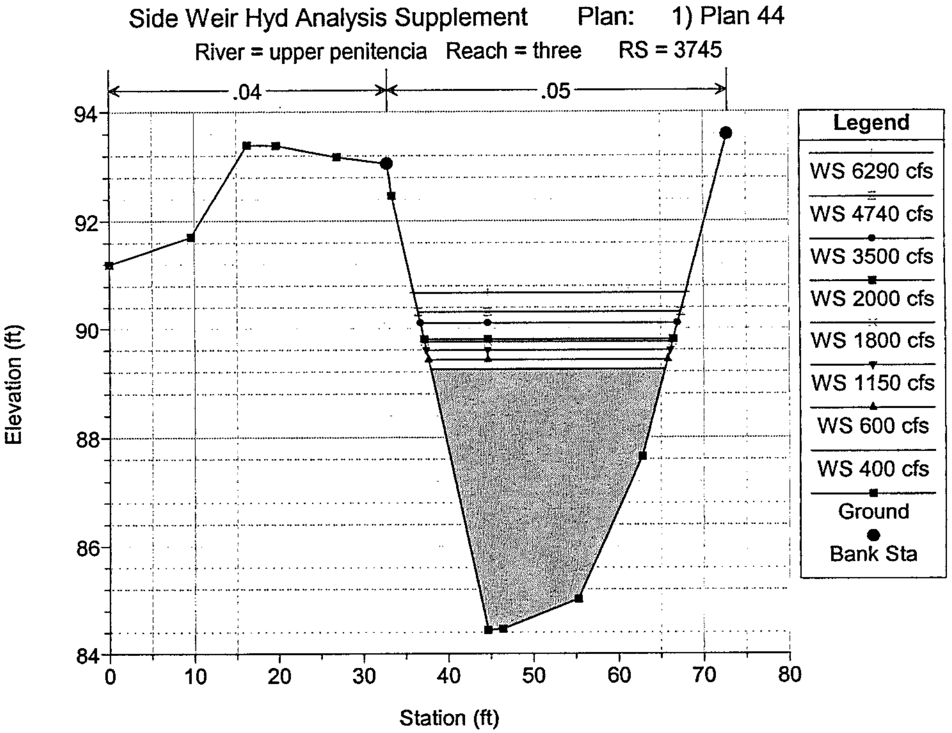

Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 3791
.04
.05
.04
Elevation (ft)
96
94
92
90
88
86
84
-40
-20
0
20
40
60
80
100
Station (ft)
Legend
WS 6290 cfs
WS 4740 cfs
WS 3500 cfs
WS 2000 cfs
WS 1800 cfs
WS 1150 cfs
WS 600 cfs
WS 400 cfs
Ground
Levee
Bank Sta

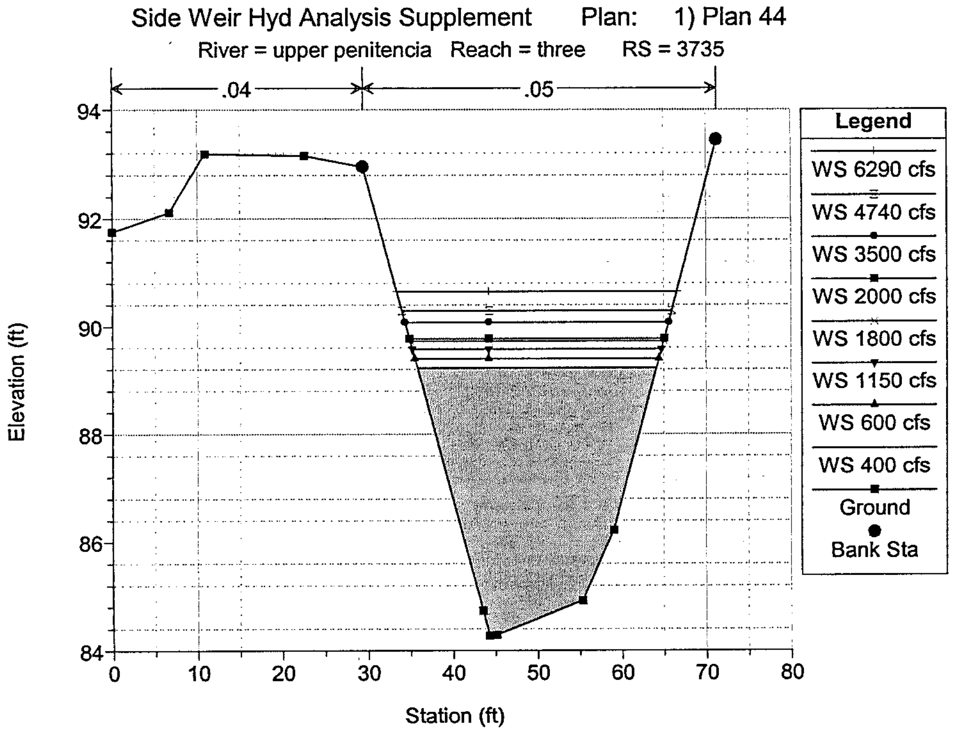

Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 3785
.04
.05
Elevation (ft)
96
94
92
90
88
86
84
0
20
40
60
80
Station (ft)
Legend
WS 6290 cfs
WS 4740 cfs
WS 3500 cfs
WS 2000 cfs
WS 1800 cfs
WS 1150 cfs
WS 600 cfs
WS 400 cfs
Ground
Bank Sta

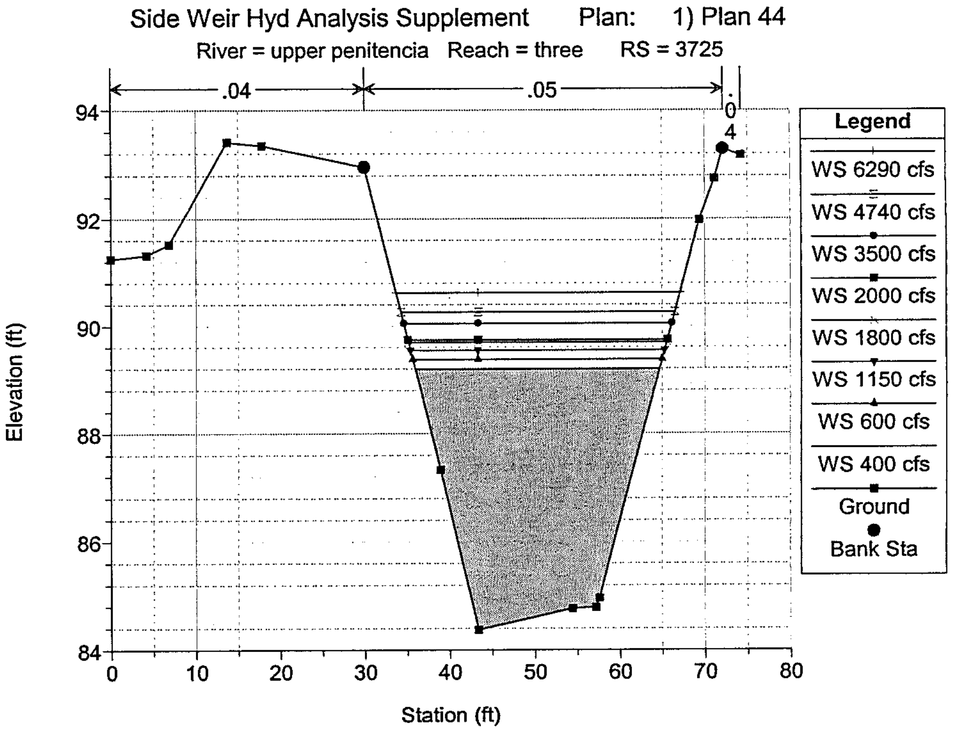

Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 3775
.04
.05
Elevation (ft)
94
92
90
88
86
84
0
20
40
60
80
Station (ft)
Legend
WS 6290 cfs
WS 4740 cfs
WS 3500 cfs
WS 2000 cfs
WS 1800 cfs
WS 1150 cfs
WS 600 cfs
WS 400 cfs
Ground
Bank Sta

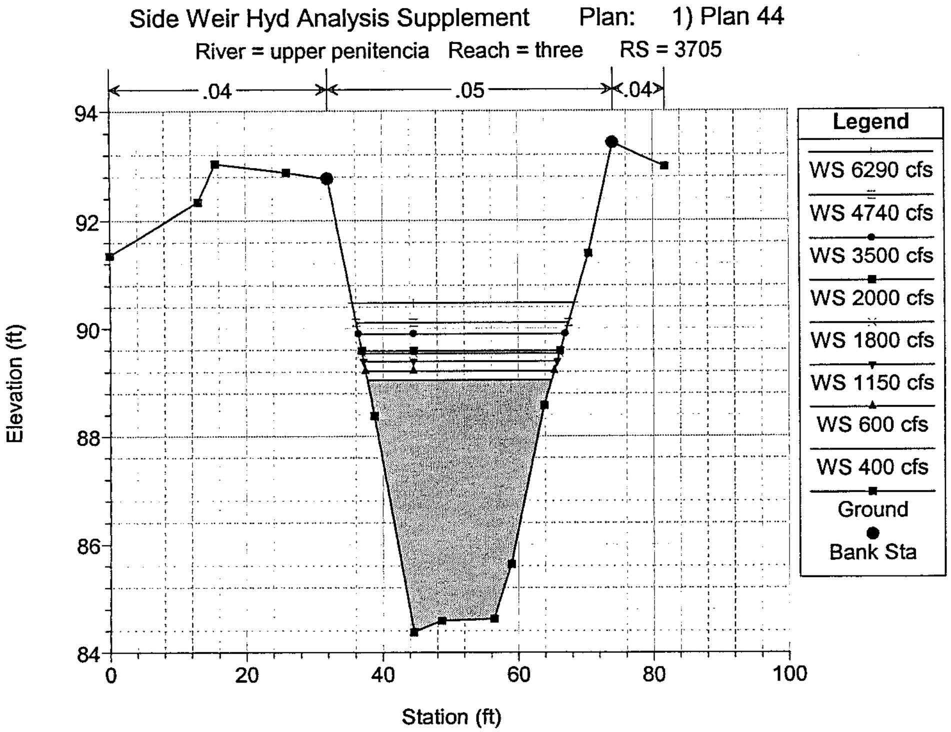

Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 3765
.04
.05
Elevation (ft)
94
92
90
88
86
84
0
20
40
60
80
Station (ft)
Legend
WS 6290 cfs
WS 4740 cfs
WS 3500 cfs
WS 2000 cfs
WS 1800 cfs
WS 1150 cfs
WS 600 cfs
WS 400 cfs
Ground
Bank Sta


Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 3755
.04
.05
Elevation (ft)
94
92
90
88
86
84
Station (ft)
0
10
20
30
40
50
60
70
80
Legend
WS 6290 cfs
WS 4740 cfs
WS 3500 cfs
WS 2000 cfs
WS 1800 cfs
WS 1150 cfs
WS 600 cfs
WS 400 cfs
Ground
Bank Sta

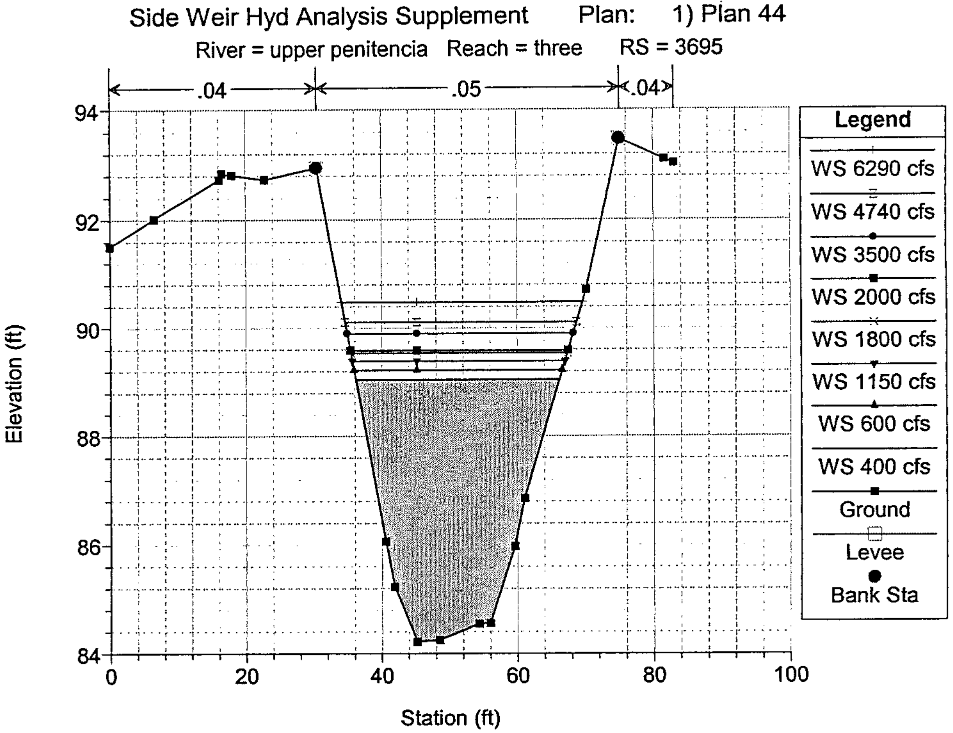

Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 3745
.04
.05
Elevation (ft)
94
92
90
88
86
84
Station (ft)
0
10
20
30
40
50
60
70
80
Legend
WS 6290 cfs
WS 4740 cfs
WS 3500 cfs
WS 2000 cfs
WS 1800 cfs
WS 1150 cfs
WS 600 cfs
WS 400 cfs
Ground
Bank Sta


Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 3735
.04
.05
Elevation (ft)
94
92
90
88
86
84
Station (ft)
0
10
20
30
40
50
60
70
80
Legend
WS 6290 cfs
WS 4740 cfs
WS 3500 cfs
WS 2000 cfs
WS 1800 cfs
WS 1150 cfs
WS 600 cfs
WS 400 cfs
Ground
Bank Sta

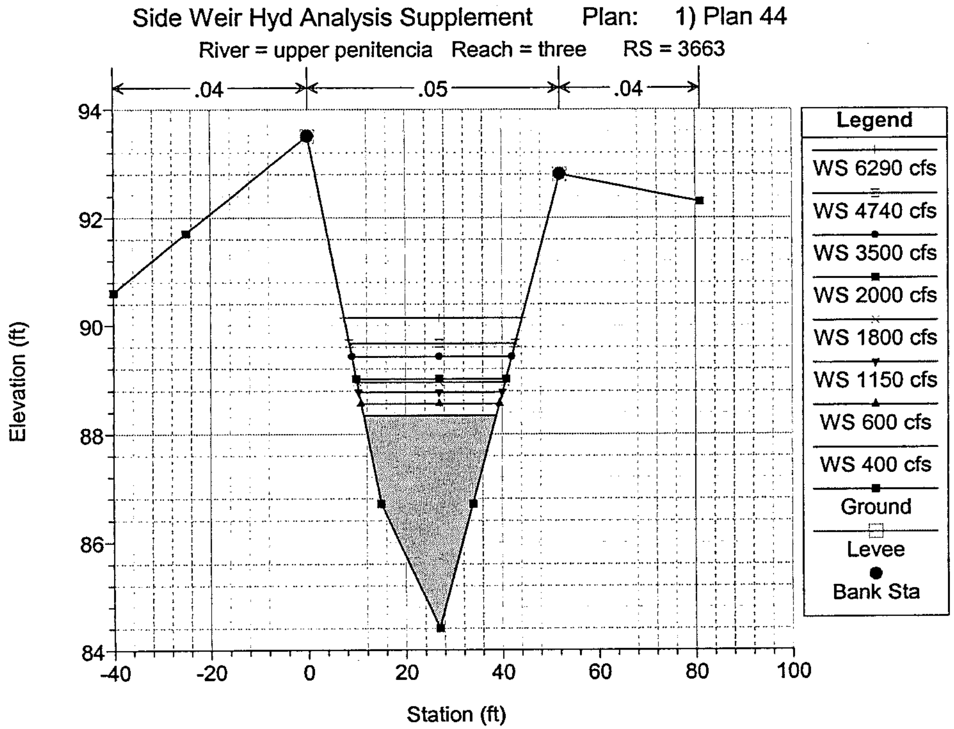

Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 3725
.04
.05
.04
Elevation (ft)
94
92
90
88
86
84
Station (ft)
0
10
20
30
40
50
60
70
80
Legend
WS 6290 cfs
WS 4740 cfs
WS 3500 cfs
WS 2000 cfs
WS 1800 cfs
WS 1150 cfs
WS 600 cfs
WS 400 cfs
Ground
Bank Sta


Side Weir Hyd Analysis Supplement Plan: 1) Plan 44

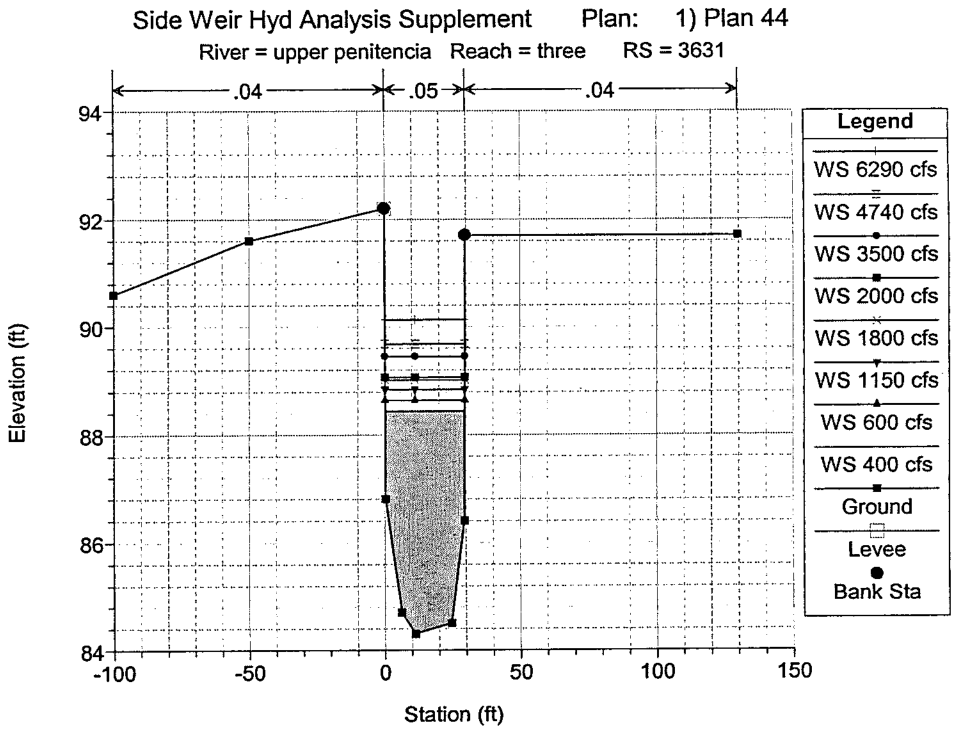
River = upper penitencia Reach = three RS = 3705


Side Weir Hyd Analysis Supplement Plan: 1) Plan 44

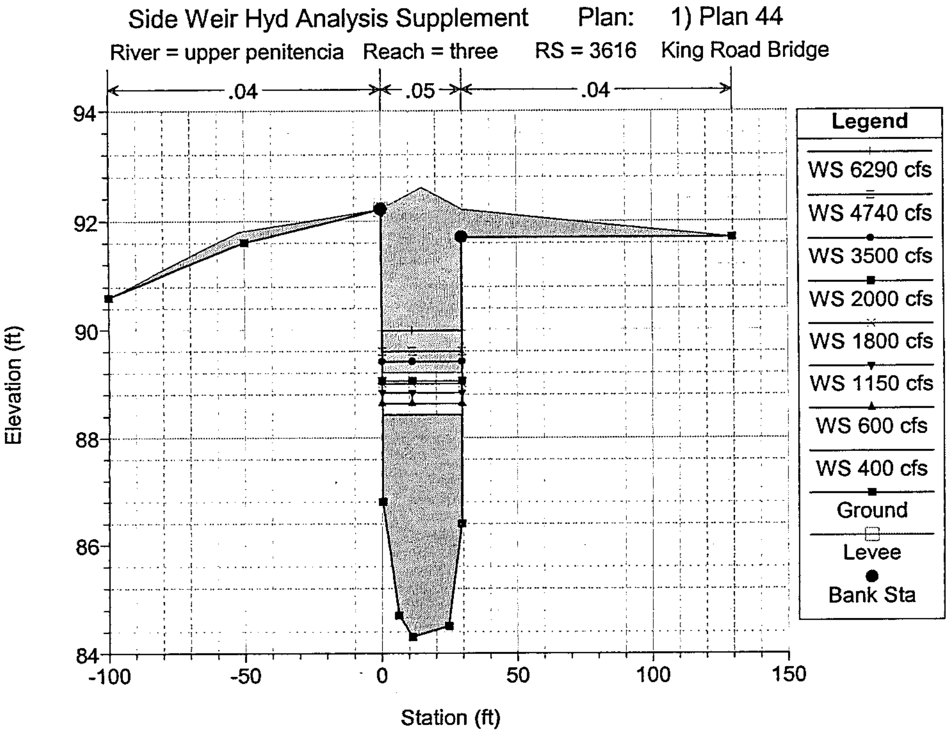
River = upper penitencia Reach = three RS = 3695

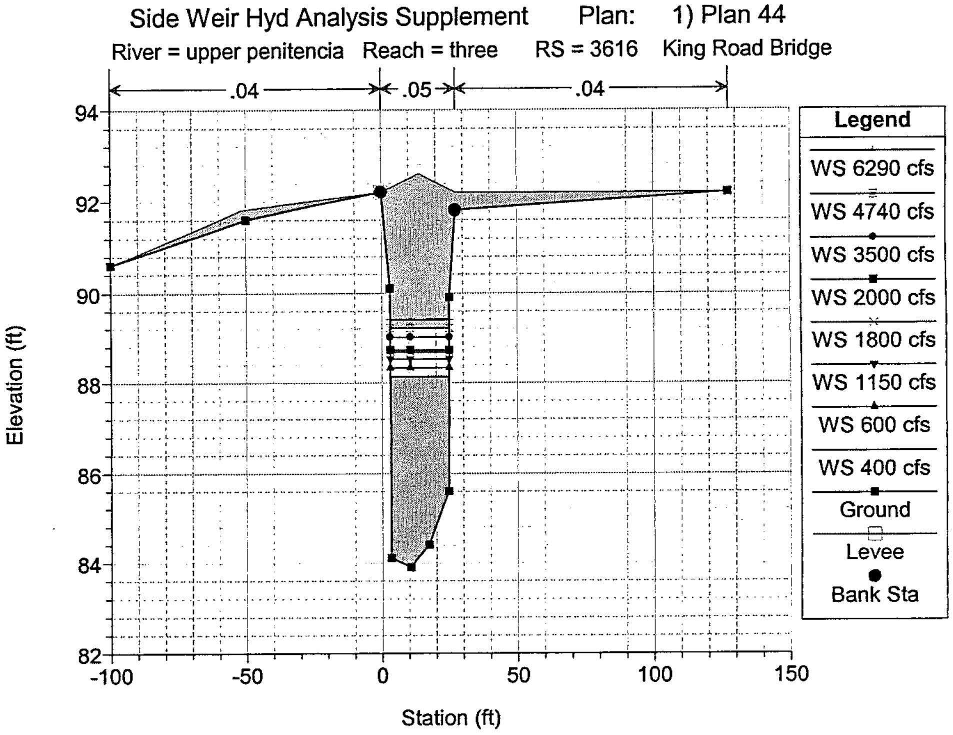

Side Weir Hyd Analysis Supplement Plan: 1) Plan 44

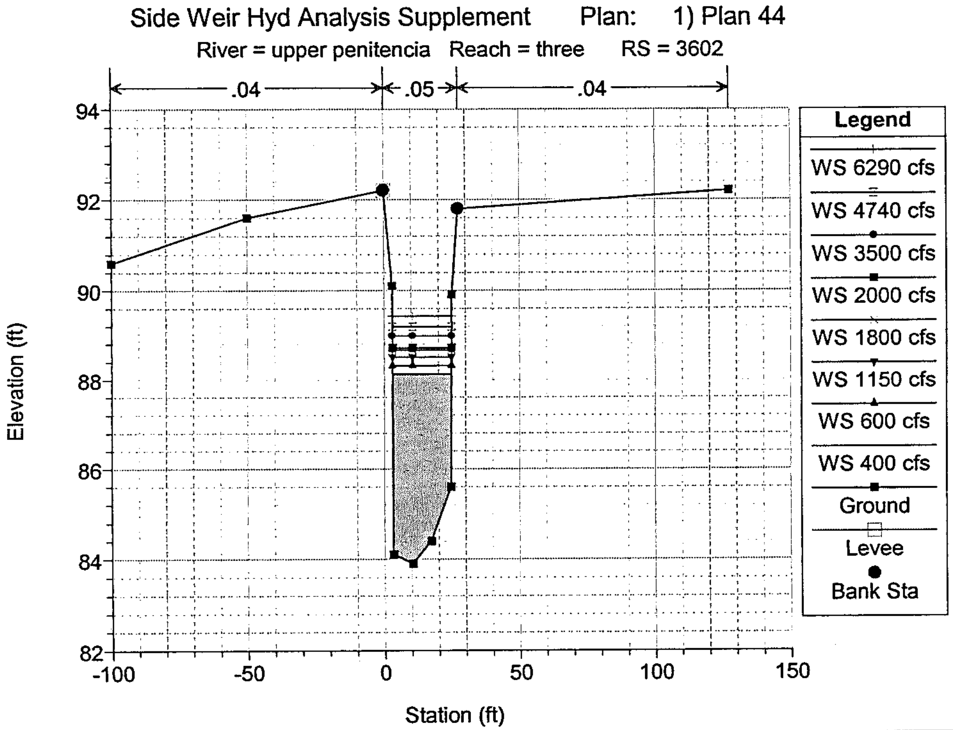
River = upper penitencia Reach = three RS = 3663

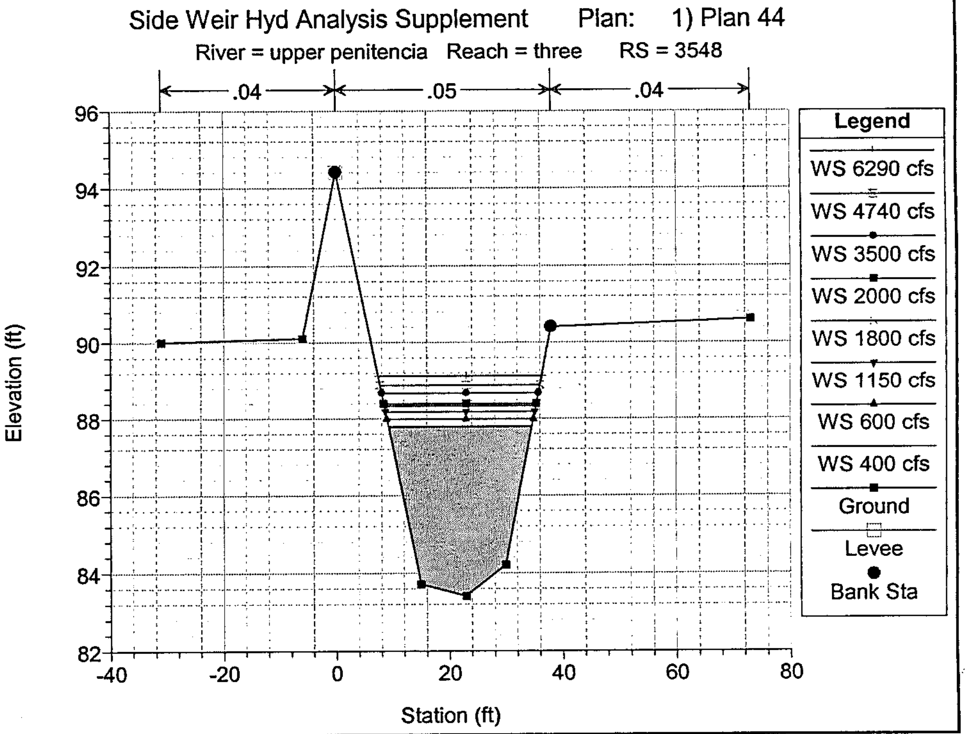

Side Weir Hyd Analysis Supplement Plan: 1) Plan 44

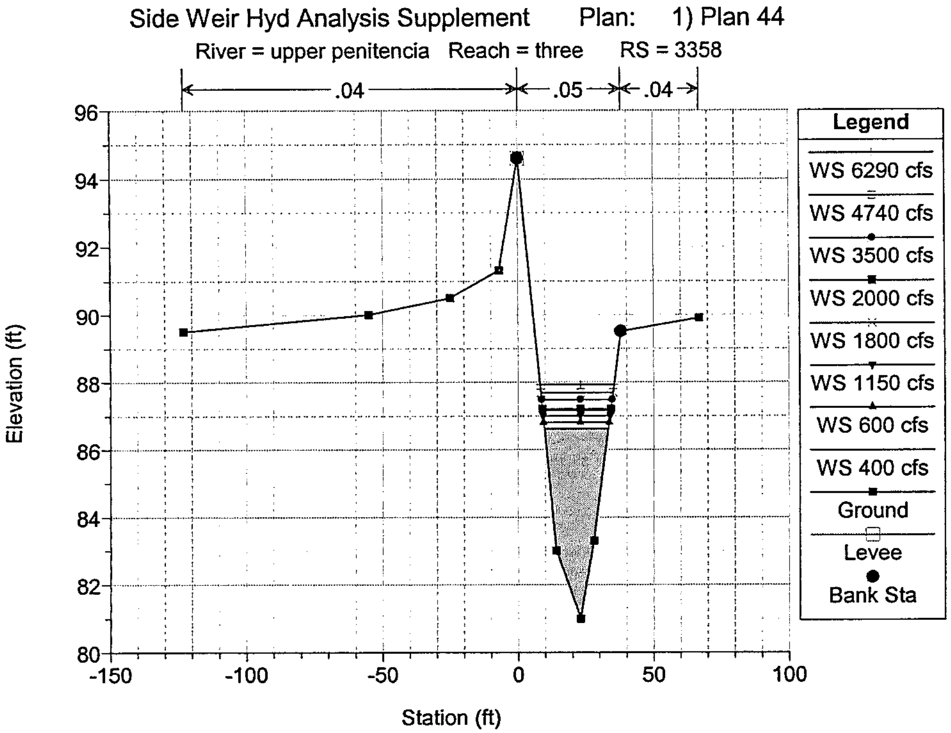
River = upper penitencia Reach = three RS = 3631

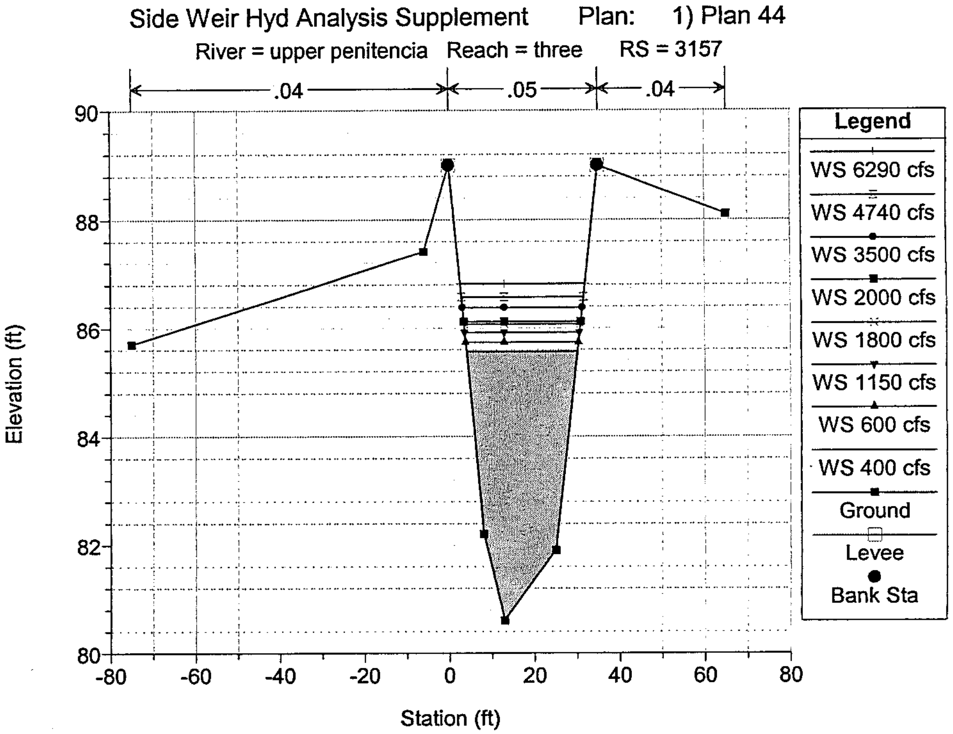

Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 3616 King Road Bridge

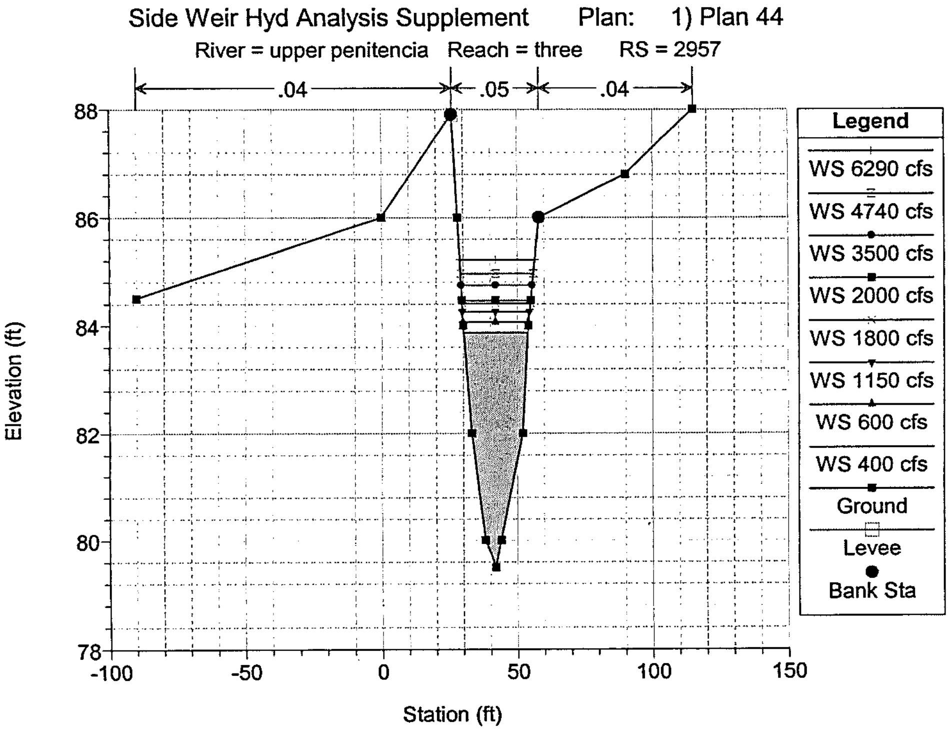

Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 3616 King Road Bridge

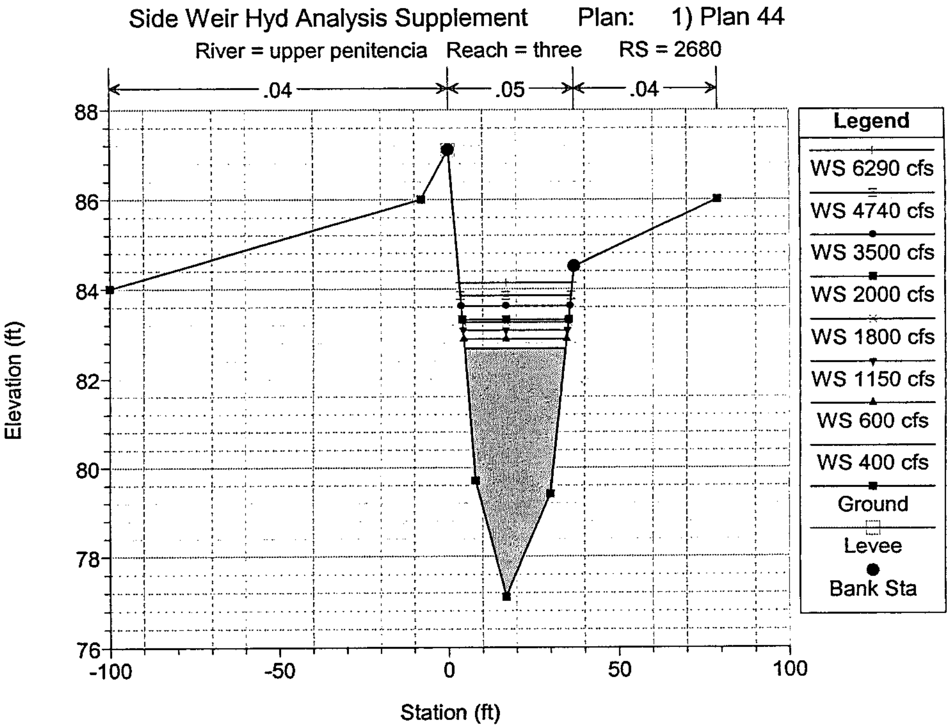

Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 3602

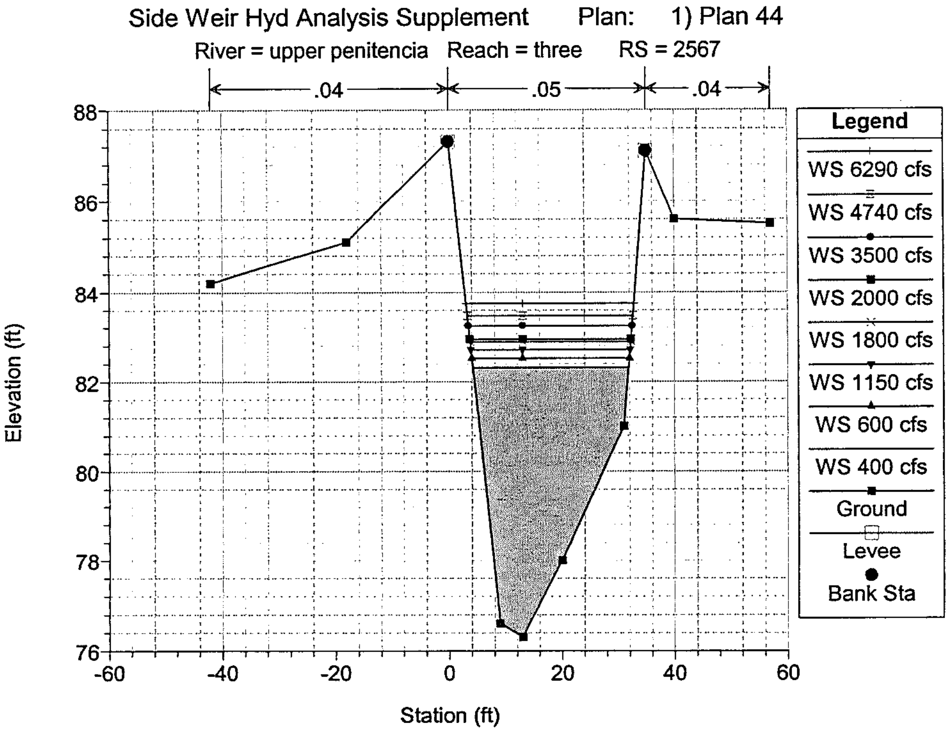

Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 3548

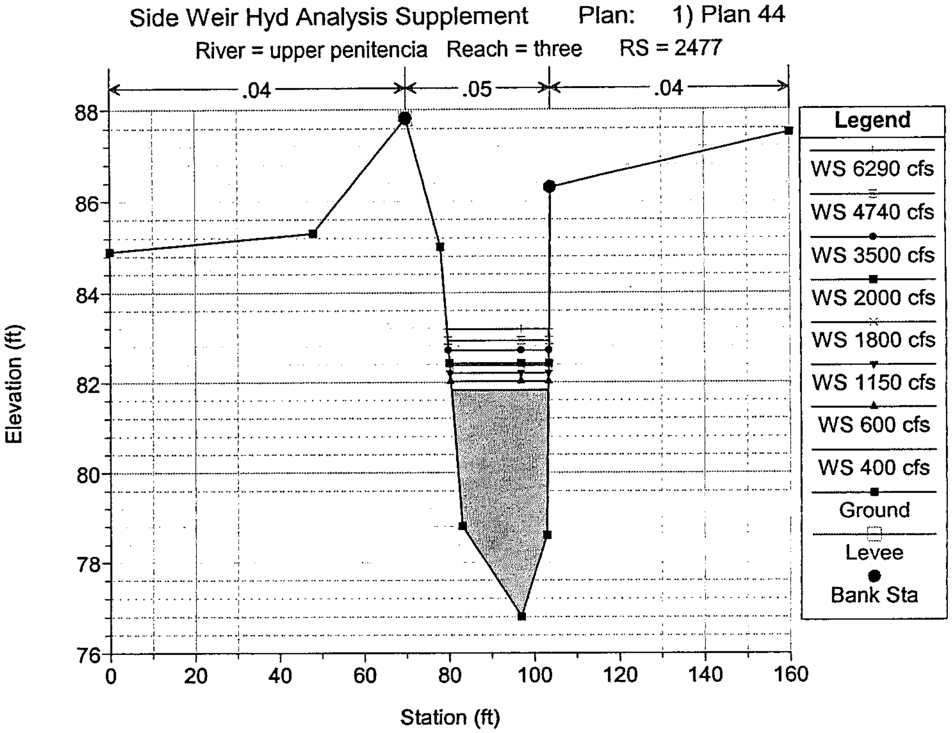

Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 3358

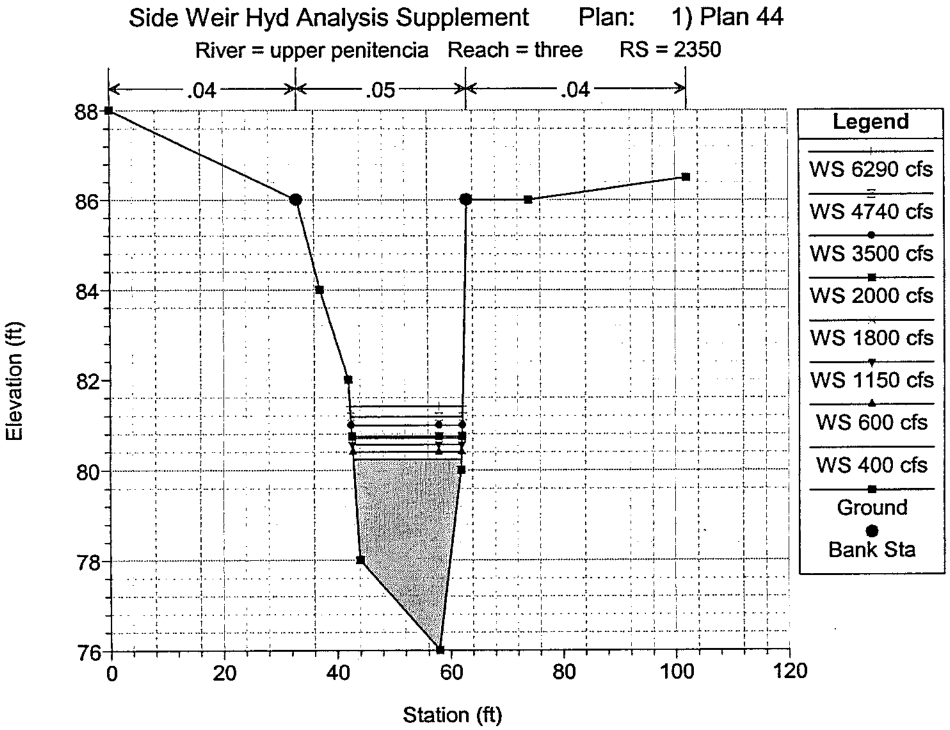

Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 3157

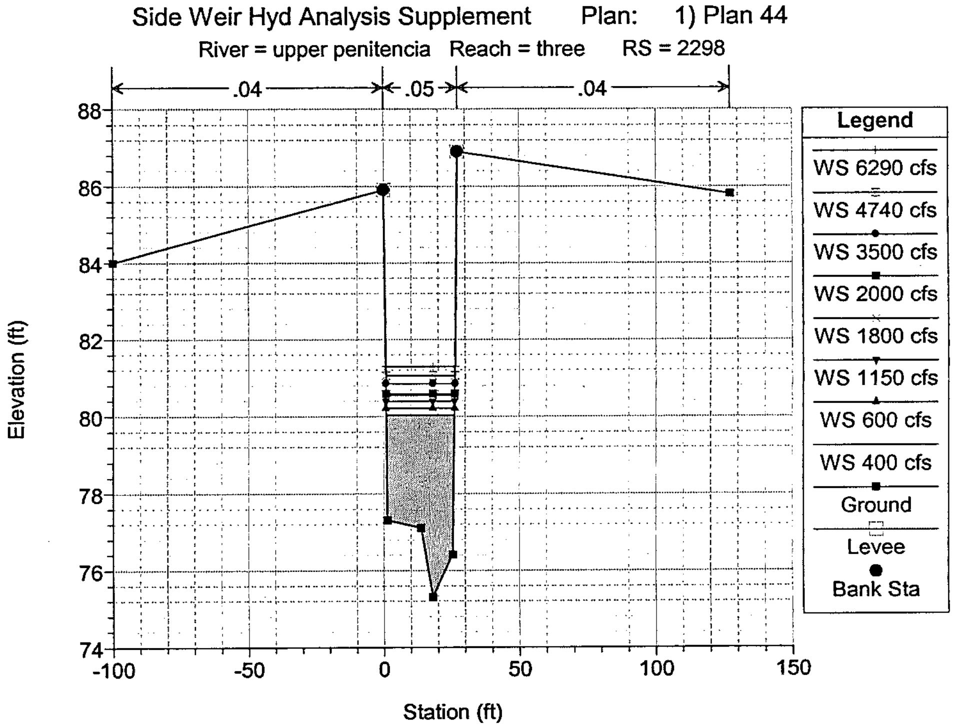

Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 2957

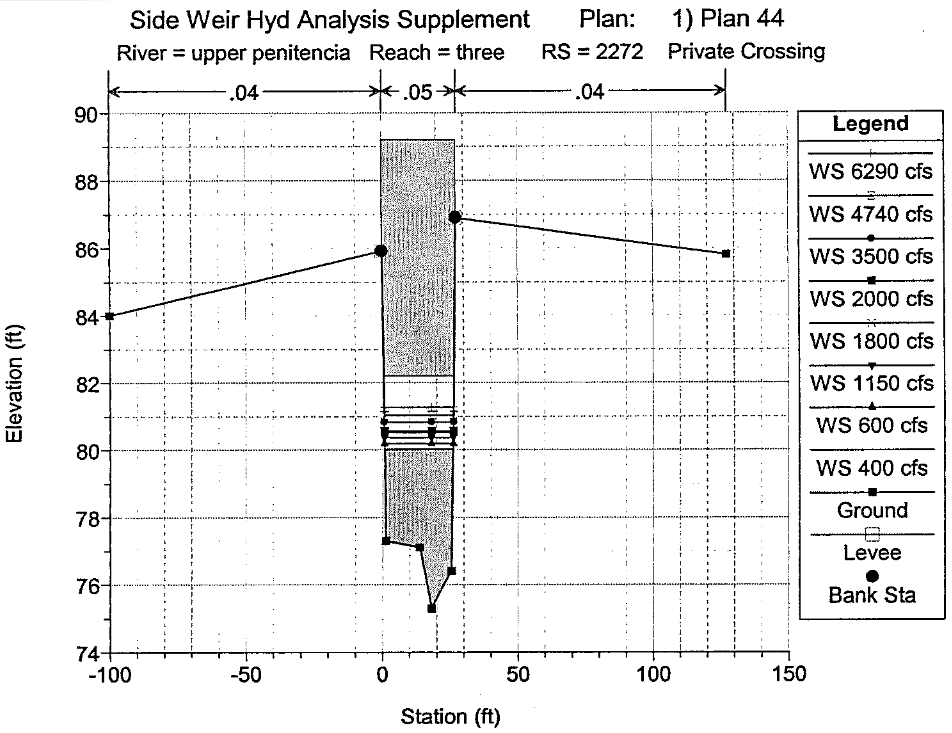

Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 2680

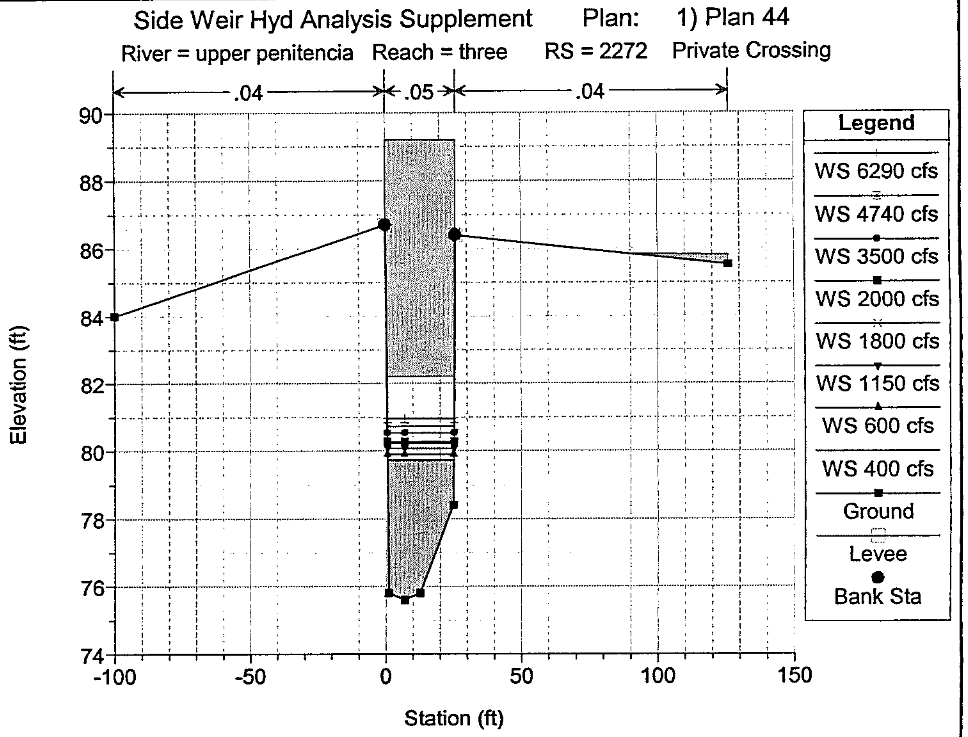

Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 2567
.04
.05
.04
Elevation (ft)
88
86
84
82
80
78
76
-60
-40
-20
0
20
40
60
Station (ft)
Legend
WS 6290 cfs
WS 4740 cfs
WS 3500 cfs
WS 2000 cfs
WS 1800 cfs
WS 1150 cfs
WS 600 cfs
WS 400 cfs
Ground
Levee
Bank Sta


Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 2477
.04
.05
.04
Elevation (ft)
88
86
84
82
80
78
76
0
20
40
60
80
100
120
140
160
Station (ft)
Legend
WS 6290 cfs
WS 4740 cfs
WS 3500 cfs
WS 2000 cfs
WS 1800 cfs
WS 1150 cfs
WS 600 cfs
WS 400 cfs
Ground
Levee
Bank Sta


Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 2350
.04
.05
.04
Elevation (ft)
88
86
84
82
80
78
76
0
20
40
60
80
100
120
Station (ft)
Legend
WS 6290 cfs
WS 4740 cfs
WS 3500 cfs
WS 2000 cfs
WS 1800 cfs
WS 1150 cfs
WS 600 cfs
WS 400 cfs
Ground
Bank Sta


Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 2298
.04
.05
.04
Elevation (ft)
88
86
84
82
80
78
76
74
-100
-50
0
50
100
150
Station (ft)
Legend
WS 6290 cfs
WS 4740 cfs
WS 3500 cfs
WS 2000 cfs
WS 1800 cfs
WS 1150 cfs
WS 600 cfs
WS 400 cfs
Ground
Levee
Bank Sta


Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 2272 Private Crossing
.04
.05
.04
Legend
WS 6290 cfs
WS 4740 cfs
WS 3500 cfs
WS 2000 cfs
WS 1800 cfs
WS 1150 cfs
WS 600 cfs
WS 400 cfs
Ground
Levee
Bank Sta
Elevation (ft)
90
88
86
84
82
80
78
76
74
Station (ft)
-100
-50
0
50
100
150


Side Weir Hyd Analysis Supplement Plan: 1) Plan 44
River = upper penitencia Reach = three RS = 2272 Private Crossing
.04
.05
.04
Legend
WS 6290 cfs
WS 4740 cfs
WS 3500 cfs
WS 2000 cfs
WS 1800 cfs
WS 1150 cfs
WS 600 cfs
WS 400 cfs
Ground
Levee
Bank Sta
Elevation (ft)
90
88
86
84
82
80
78
76
74
Station (ft)
-100
-50
0
50
100
150

Drop Structure at Bypass Outlet with 45-Degree Deflection Wall

HEC-RAS Plan: Plan 02 River: Bypass Reach: Bypass to Coyote

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Bypass to Coyote	167.7	1130.00	67.50	71.19	71.19	73.05	0.002929	10.95	103.22	28.00	1.00
Bypass to Coyote	167.7	2070.00	67.50	73.02	73.02	75.81	0.002919	13.39	154.56	28.00	1.00
Bypass to Coyote	167.7	3530.00	67.50	75.38	75.38	79.35	0.003018	16.00	220.62	28.00	1.00
Bypass to Coyote	167.7	4140.00	67.50	76.26	76.26	80.68	0.003070	16.87	245.36	28.00	1.00
Bypass to Coyote	167.7	5360.00	67.50	79.24		83.37	0.002285	16.30	328.81	28.00	0.84
Bypass to Coyote	166.066*	1130.00	67.50	71.19	71.19	73.05	0.002929	10.95	103.22	28.00	1.00
Bypass to Coyote	166.066*	2070.00	67.50	73.02	73.02	75.81	0.002919	13.39	154.56	28.00	1.00
Bypass to Coyote	166.066*	3530.00	67.50	75.38	75.38	79.35	0.003018	16.00	220.62	28.00	1.00
Bypass to Coyote	166.066*	4140.00	67.50	76.26	76.26	80.68	0.003070	16.87	245.36	28.00	1.00
Bypass to Coyote	166.066*	5360.00	67.50	79.18		83.35	0.002318	16.39	327.10	28.00	0.84
Bypass to Coyote	164.433*	1130.00	67.50	71.19	71.19	73.05	0.002929	10.95	103.22	28.00	1.00
Bypass to Coyote	164.433*	2070.00	67.50	73.02	73.02	75.81	0.002919	13.39	154.56	28.00	1.00
Bypass to Coyote	164.433*	3530.00	67.50	75.38	75.38	79.35	0.003018	16.00	220.62	28.00	1.00
Bypass to Coyote	164.433*	4140.00	67.50	76.26	76.26	80.68	0.003070	16.87	245.36	28.00	1.00
Bypass to Coyote	164.433*	5360.00	67.50	79.12		83.33	0.002351	16.47	325.40	28.00	0.85
Bypass to Coyote	162.8	1130.00	67.50	71.19	71.19	73.05	0.002929	10.95	103.22	28.00	1.00
Bypass to Coyote	162.8	2070.00	67.50	73.02	73.02	75.81	0.002919	13.39	154.56	28.00	1.00
Bypass to Coyote	162.8	3530.00	67.50	75.38	75.38	79.35	0.003018	16.00	220.62	28.00	1.00
Bypass to Coyote	162.8	4140.00	67.50	76.26	76.26	80.68	0.003070	16.87	245.36	28.00	1.00
Bypass to Coyote	162.8	5360.00	67.50	79.05		83.32	0.002389	16.57	323.48	28.00	0.86
Bypass to Coyote	161.8	1130.00	67.50	71.19	71.19	73.05	0.002929	10.95	103.22	28.00	1.00
Bypass to Coyote	161.8	2070.00	67.50	73.02	73.02	75.81	0.002919	13.39	154.56	28.00	1.00
Bypass to Coyote	161.8	3530.00	67.50	75.38	75.38	79.35	0.003018	16.00	220.62	28.00	1.00
Bypass to Coyote	161.8	4140.00	67.50	76.26	76.26	80.68	0.003070	16.87	245.36	28.00	1.00
Bypass to Coyote	161.8	5360.00	67.50	78.98		83.30	0.002429	16.67	321.57	28.00	0.87
Bypass to Coyote	160.8	1130.00	67.50	71.19	71.19	73.05	0.002929	10.95	103.22	28.00	1.00
Bypass to Coyote	160.8	2070.00	67.50	73.02	73.02	75.81	0.002919	13.39	154.56	28.00	1.00
Bypass to Coyote	160.8	3530.00	67.50	75.38	75.38	79.35	0.003018	16.00	220.62	28.00	1.00
Bypass to Coyote	160.8	4140.00	67.50	76.26	76.26	80.68	0.003070	16.87	245.36	28.00	1.00
Bypass to Coyote	160.8	5360.00	67.50	78.92		83.28	0.002468	16.77	319.66	28.00	0.87
Bypass to Coyote	159.8	1130.00	67.50	71.19	71.19	73.05	0.002929	10.95	103.22	28.00	1.00
Bypass to Coyote	159.8	2070.00	67.50	73.02	73.02	75.81	0.002919	13.39	154.56	28.00	1.00
Bypass to Coyote	159.8	3530.00	67.50	75.38	75.38	79.35	0.003018	16.00	220.62	28.00	1.00
Bypass to Coyote	159.8	4140.00	67.50	76.26	76.26	80.68	0.003070	16.87	245.36	28.00	1.00
Bypass to Coyote	159.8	5360.00	67.50	78.83		83.26	0.002519	16.89	317.32	28.00	0.88
Bypass to Coyote	158.8	1130.00	67.50	71.19	71.19	73.05	0.002929	10.95	103.22	28.00	1.00
Bypass to Coyote	158.8	2070.00	67.50	73.02	73.02	75.81	0.002919	13.39	154.56	28.00	1.00
Bypass to Coyote	158.8	3530.00	67.50	75.38	75.38	79.35	0.003018	16.00	220.62	28.00	1.00
Bypass to Coyote	158.8	4140.00	67.50	76.26	76.26	80.68	0.003070	16.87	245.36	28.00	1.00
Bypass to Coyote	158.8	5360.00	67.50	78.75		83.25	0.002570	17.02	314.98	28.00	0.89
Bypass to Coyote	157.8	1130.00	67.50	71.19	71.19	73.05	0.002929	10.95	103.22	28.00	1.00
Bypass to Coyote	157.8	2070.00	67.50	73.02	73.02	75.81	0.002919	13.39	154.56	28.00	1.00
Bypass to Coyote	157.8	3530.00	67.50	75.38	75.38	79.35	0.003018	16.00	220.62	28.00	1.00
Bypass to Coyote	157.8	4140.00	67.50	76.26	76.26	80.68	0.003070	16.87	245.36	28.00	1.00
Bypass to Coyote	157.8	5360.00	67.50	77.93	77.93	83.16	0.003163	18.35	292.08	28.00	1.00
Bypass to Coyote	157.7	1130.00	55.95	69.04		69.19	0.000076	3.08	366.49	28.00	0.15
Bypass to Coyote	157.7	2070.00	55.95	71.09		71.46	0.000173	4.88	423.81	28.00	0.22
Bypass to Coyote	157.7	3530.00	55.95	73.10		73.94	0.000362	7.35	480.21	28.00	0.31
Bypass to Coyote	157.7	4140.00	55.95	75.09		76.02	0.000375	7.72	536.03	28.00	0.31
Bypass to Coyote	157.7	5360.00	55.95	77.11		78.38	0.000486	9.05	592.58	28.00	0.35
Bypass to Coyote	156.033*	1130.00	55.95	69.04		69.19	0.000076	3.08	366.45	28.00	0.15
Bypass to Coyote	156.033*	2070.00	55.95	71.08		71.45	0.000173	4.89	423.73	28.00	0.22
Bypass to Coyote	156.033*	3530.00	55.95	73.10		73.94	0.000362	7.35	480.20	28.00	0.31
Bypass to Coyote	156.033*	4140.00	55.95	75.09		76.02	0.000375	7.72	536.02	28.00	0.31
Bypass to Coyote	156.033*	5360.00	55.95	77.11		78.38	0.000486	9.05	592.57	28.00	0.35
Bypass to Coyote	154.366*	1130.00	55.95	69.04		69.18	0.000076	3.08	366.42	28.00	0.15
Bypass to Coyote	154.366*	2070.00	55.95	71.08		71.45	0.000173	4.89	423.65	28.00	0.22
Bypass to Coyote	154.366*	3530.00	55.95	73.10		73.94	0.000362	7.35	480.19	28.00	0.31
Bypass to Coyote	154.366*	4140.00	55.95	75.09		76.02	0.000375	7.72	536.02	28.00	0.31
Bypass to Coyote	154.366*	5360.00	55.95	77.11		78.38	0.000486	9.05	592.57	28.00	0.35

HEC-RAS Plan: Plan 02 River: Bypass Reach: Bypass to Coyote (Continued)

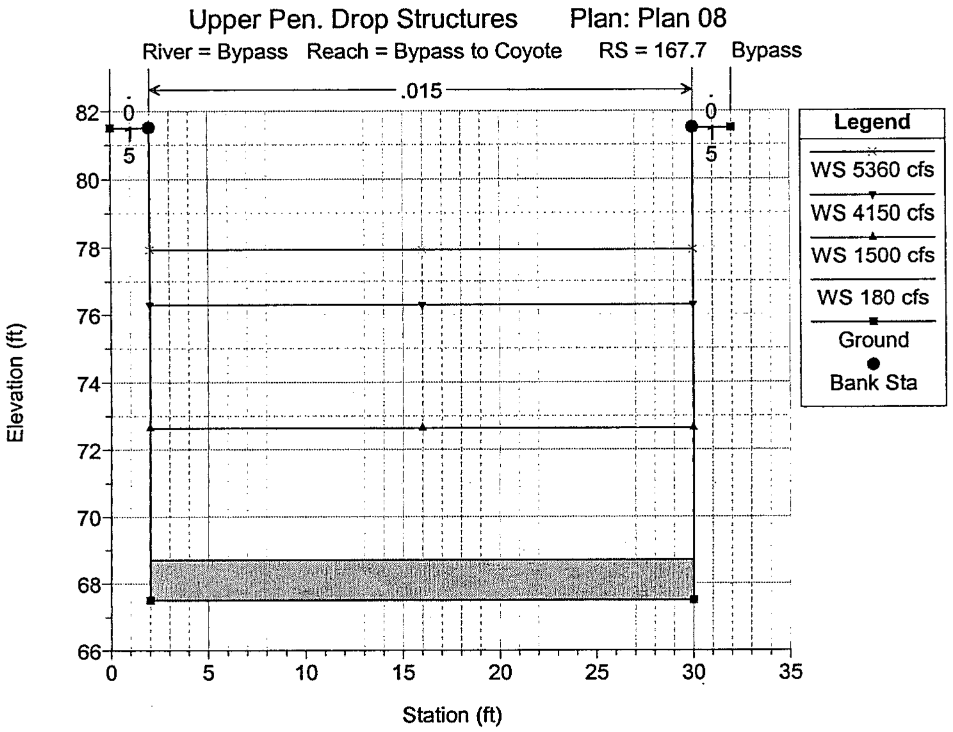
Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Bypass to Coyote	152.7	1130.00	55.95	69.04		69.18	0.000076	3.08	366.38	28.00	0.15
Bypass to Coyote	152.7	2070.00	55.95	71.08		71.45	0.000173	4.89	423.57	28.00	0.22
Bypass to Coyote	152.7	3530.00	55.95	73.10		73.94	0.000362	7.35	480.19	28.00	0.31
Bypass to Coyote	152.7	4140.00	55.95	75.09		76.02	0.000375	7.72	536.01	28.00	0.31
Bypass to Coyote	152.7	5360.00	55.95	77.11		78.38	0.000486	9.05	592.56	28.00	0.35
Bypass to Coyote	151.033*	1130.00	55.95	69.03		69.18	0.000076	3.08	366.34	28.00	0.15
Bypass to Coyote	151.033*	2070.00	55.95	71.07		71.45	0.000173	4.89	423.49	28.00	0.22
Bypass to Coyote	151.033*	3530.00	55.95	73.10		73.94	0.000362	7.35	480.18	28.00	0.31
Bypass to Coyote	151.033*	4140.00	55.95	75.09		76.02	0.000375	7.72	536.01	28.00	0.31
Bypass to Coyote	151.033*	5360.00	55.95	77.11		78.38	0.000486	9.05	592.56	28.00	0.35
Bypass to Coyote	149.366*	1130.00	55.95	69.03		69.18	0.000076	3.08	366.31	28.00	0.15
Bypass to Coyote	149.366*	2070.00	55.95	71.07		71.44	0.000173	4.89	423.41	28.00	0.22
Bypass to Coyote	149.366*	3530.00	55.95	73.10		73.94	0.000362	7.35	480.18	28.00	0.31
Bypass to Coyote	149.366*	4140.00	55.95	75.09		76.02	0.000375	7.72	536.00	28.00	0.31
Bypass to Coyote	149.366*	5360.00	55.95	77.11		78.38	0.000486	9.05	592.55	28.00	0.35
Bypass to Coyote	147.7	1130.00	55.95	69.03		69.18	0.000076	3.09	366.27	28.00	0.15
Bypass to Coyote	147.7	2070.00	55.95	71.07		71.44	0.000173	4.89	423.33	28.00	0.22
Bypass to Coyote	147.7	3530.00	55.95	73.10		73.94	0.000362	7.35	480.17	28.00	0.31
Bypass to Coyote	147.7	4140.00	55.95	75.09		76.02	0.000375	7.72	535.99	28.00	0.31
Bypass to Coyote	147.7	5360.00	55.95	77.11		78.38	0.000486	9.05	592.55	28.00	0.35
Bypass to Coyote	146.033*	1130.00	55.95	69.03		69.18	0.000076	3.09	366.24	28.00	0.15
Bypass to Coyote	146.033*	2070.00	55.95	71.07		71.44	0.000173	4.89	423.25	28.00	0.22
Bypass to Coyote	146.033*	3530.00	55.95	73.10		73.94	0.000362	7.35	480.16	28.00	0.31
Bypass to Coyote	146.033*	4140.00	55.95	75.09		76.02	0.000375	7.72	535.99	28.00	0.31
Bypass to Coyote	146.033*	5360.00	55.95	77.11		78.38	0.000486	9.05	592.54	28.00	0.35
Bypass to Coyote	144.366*	1130.00	55.95	69.03		69.18	0.000076	3.09	366.20	28.00	0.15
Bypass to Coyote	144.366*	2070.00	55.95	71.06		71.43	0.000173	4.89	423.17	28.00	0.22
Bypass to Coyote	144.366*	3530.00	55.95	73.10		73.94	0.000362	7.35	480.16	28.00	0.31
Bypass to Coyote	144.366*	4140.00	55.95	75.09		76.02	0.000375	7.72	535.98	28.00	0.31
Bypass to Coyote	144.366*	5360.00	55.95	77.11		78.38	0.000478	9.04	594.35	32.00	0.35
Bypass to Coyote	142.7	1130.00	55.95	69.03		69.18	0.000076	3.09	366.16	28.00	0.15
Bypass to Coyote	142.7	2070.00	55.95	71.06		71.43	0.000173	4.89	423.09	28.00	0.22
Bypass to Coyote	142.7	3530.00	55.95	73.10		73.94	0.000362	7.35	480.15	28.00	0.31
Bypass to Coyote	142.7	4140.00	55.95	75.09		76.02	0.000373	7.72	536.34	32.00	0.31
Bypass to Coyote	142.7	5360.00	55.95	77.12		78.37	0.000445	9.01	601.11	32.00	0.35
Bypass to Coyote	141.033*	1130.00	55.95	69.03		69.17	0.000076	3.09	366.13	28.00	0.15
Bypass to Coyote	141.033*	2070.00	55.95	71.06		71.43	0.000173	4.89	423.01	28.00	0.22
Bypass to Coyote	141.033*	3530.00	55.95	73.10		73.94	0.000362	7.35	480.14	28.00	0.31
Bypass to Coyote	141.033*	4140.00	55.95	75.09		76.01	0.000346	7.70	543.11	32.00	0.31
Bypass to Coyote	141.033*	5360.00	55.95	77.12		78.36	0.000412	8.98	607.87	32.00	0.34
Bypass to Coyote	139.366*	1130.00	55.95	69.02		69.17	0.000076	3.09	366.09	28.00	0.15
Bypass to Coyote	139.366*	2070.00	55.95	71.05		71.43	0.000173	4.89	422.93	28.00	0.22
Bypass to Coyote	139.366*	3530.00	55.95	73.10		73.93	0.000338	7.33	485.94	32.00	0.31
Bypass to Coyote	139.366*	4140.00	55.95	75.10		76.00	0.000319	7.67	549.83	32.00	0.31
Bypass to Coyote	139.366*	5360.00	55.95	77.12		78.35	0.000380	8.95	614.60	32.00	0.34
Bypass to Coyote	137.7	1130.00	55.95	69.02		69.17	0.000076	3.09	366.05	28.00	0.15
Bypass to Coyote	137.7	2070.00	55.95	71.05		71.42	0.000165	4.89	427.05	32.00	0.22
Bypass to Coyote	137.7	3530.00	55.95	73.10		73.93	0.000310	7.30	492.71	32.00	0.31
Bypass to Coyote	137.7	4140.00	55.95	75.10		76.00	0.000293	7.64	556.59	32.00	0.31
Bypass to Coyote	137.7	5360.00	55.95	77.12		78.34	0.000350	8.92	621.36	32.00	0.34
Bypass to Coyote	136.033*	1130.00	55.95	69.02		69.17	0.000076	3.09	366.02	28.00	0.15
Bypass to Coyote	136.033*	2070.00	55.95	71.05		71.42	0.000165	4.89	426.96	32.00	0.22
Bypass to Coyote	136.033*	3530.00	55.95	73.10		73.92	0.000310	7.30	492.53	32.00	0.31
Bypass to Coyote	136.033*	4140.00	55.95	75.09		75.99	0.000293	7.64	556.42	32.00	0.31
Bypass to Coyote	136.033*	5360.00	55.95	77.12		78.34	0.000350	8.92	621.14	32.00	0.34
Bypass to Coyote	134.366*	1130.00	55.95	69.02		69.17	0.000076	3.09	365.98	28.00	0.15
Bypass to Coyote	134.366*	2070.00	55.95	71.05		71.42	0.000165	4.89	426.87	32.00	0.22
Bypass to Coyote	134.366*	3530.00	55.95	73.09		73.91	0.000311	7.30	492.35	32.00	0.31
Bypass to Coyote	134.366*	4140.00	55.95	75.09		75.99	0.000294	7.64	556.24	32.00	0.31
Bypass to Coyote	134.366*	5360.00	55.95	77.11		78.33	0.000350	8.93	620.92	32.00	0.34

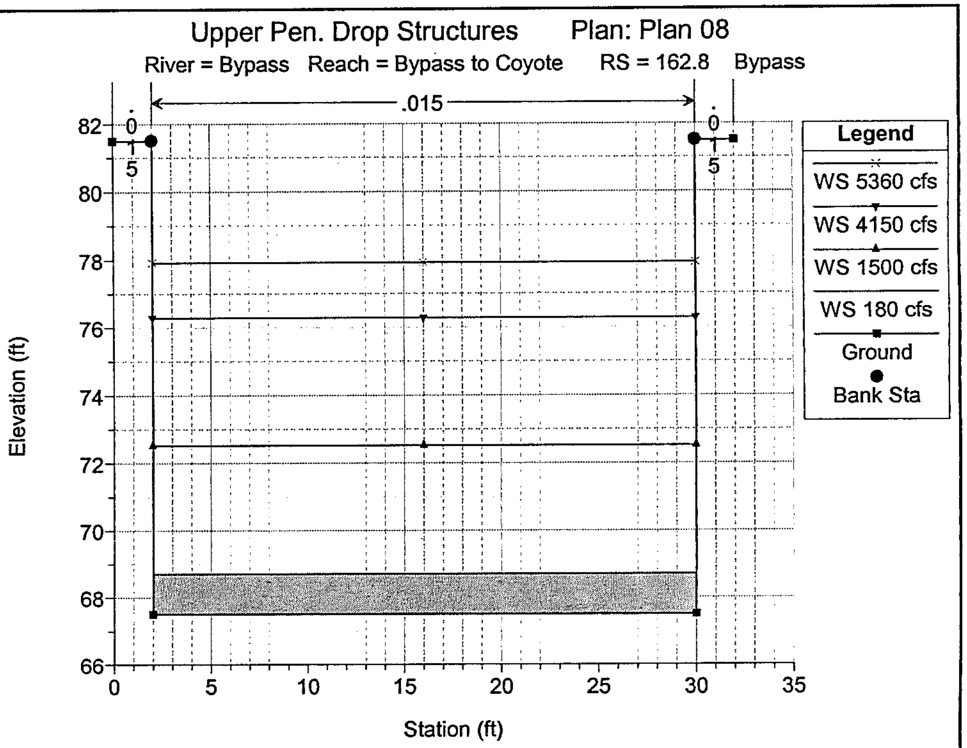
HEC-RAS Plan: Plan 02 River: Bypass Reach: Bypass to Coyote (Continued)

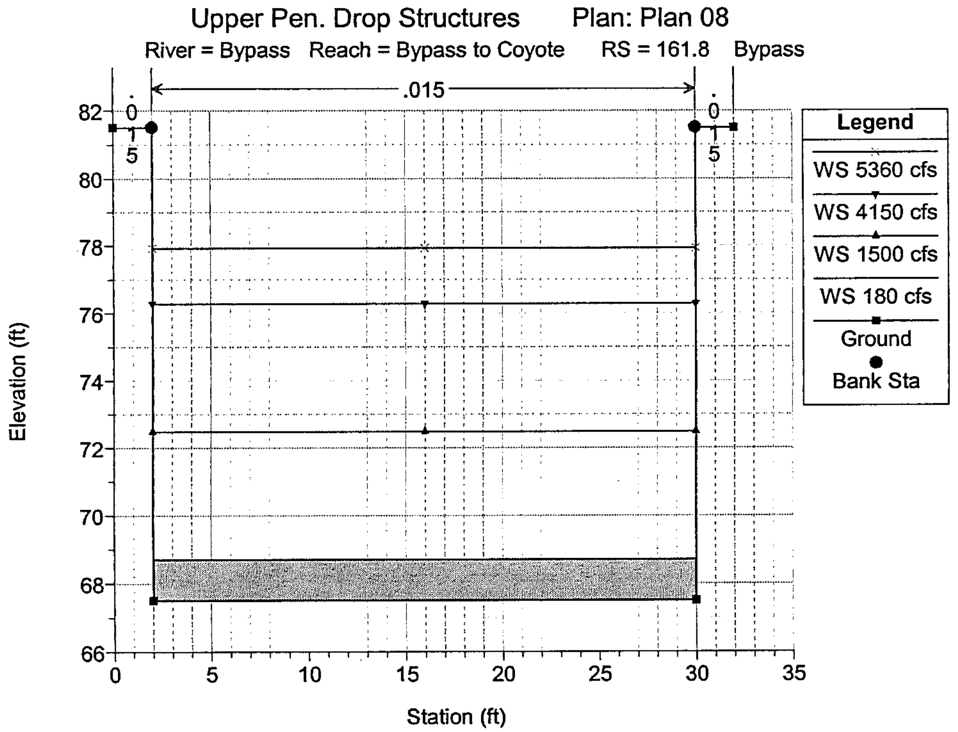
Reach	River Sta	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Bypass to Coyote	132.7	1130.00	55.95	69.02		69.17	0.000076	3.09	365.94	28.00	0.15
Bypass to Coyote	132.7	2070.00	55.95	71.04		71.41	0.000165	4.89	426.78	32.00	0.22
Bypass to Coyote	132.7	3530.00	55.95	73.09		73.91	0.000311	7.31	492.16	32.00	0.31
Bypass to Coyote	132.7	4140.00	55.95	75.08		75.98	0.000294	7.65	556.06	32.00	0.31
Bypass to Coyote	132.7	5360.00	55.95	77.10		78.33	0.000351	8.93	620.70	32.00	0.34
Bypass to Coyote	131.033*	1130.00	55.95	69.02		69.17	0.000076	3.09	365.91	28.00	0.15
Bypass to Coyote	131.033*	2070.00	55.95	71.04		71.41	0.000165	4.89	426.69	32.00	0.22
Bypass to Coyote	131.033*	3530.00	55.95	73.08		73.90	0.000311	7.31	491.98	32.00	0.31
Bypass to Coyote	131.033*	4140.00	55.95	75.08		75.98	0.000294	7.65	555.88	32.00	0.31
Bypass to Coyote	131.033*	5360.00	55.95	77.10		78.32	0.000351	8.93	620.48	32.00	0.34
Bypass to Coyote	129.366*	1130.00	55.95	69.02		69.16	0.000076	3.09	365.87	28.00	0.15
Bypass to Coyote	129.366*	2070.00	55.95	71.04		71.41	0.000165	4.89	426.59	32.00	0.22
Bypass to Coyote	129.366*	3530.00	55.95	73.07		73.90	0.000312	7.31	491.79	32.00	0.31
Bypass to Coyote	129.366*	4140.00	55.95	75.07		75.97	0.000295	7.65	555.71	32.00	0.31
Bypass to Coyote	129.366*	5360.00	55.95	77.09		78.31	0.000352	8.94	620.26	32.00	0.34
Bypass to Coyote	127.7	1130.00	55.95	69.02		69.16	0.000076	3.09	365.84	28.00	0.15
Bypass to Coyote	127.7	2070.00	55.95	71.03		71.41	0.000165	4.89	426.50	32.00	0.22
Bypass to Coyote	127.7	3530.00	55.95	73.07		73.89	0.000312	7.31	491.61	32.00	0.31
Bypass to Coyote	127.7	4140.00	55.95	75.07		75.97	0.000295	7.65	555.53	32.00	0.31
Bypass to Coyote	127.7	5360.00	55.95	77.08		78.31	0.000352	8.94	620.04	32.00	0.34
Bypass to Coyote	126.033*	1130.00	55.95	69.01		69.16	0.000076	3.09	365.80	28.00	0.15
Bypass to Coyote	126.033*	2070.00	55.95	71.03		71.40	0.000165	4.89	426.41	32.00	0.22
Bypass to Coyote	126.033*	3530.00	55.95	73.06		73.89	0.000312	7.32	491.42	32.00	0.31
Bypass to Coyote	126.033*	4140.00	55.95	75.06		75.96	0.000295	7.65	555.35	32.00	0.31
Bypass to Coyote	126.033*	5360.00	55.95	77.08		78.30	0.000352	8.94	619.82	32.00	0.34
Bypass to Coyote	124.366*	1130.00	55.95	69.01		69.16	0.000076	3.09	365.76	28.00	0.15
Bypass to Coyote	124.366*	2070.00	55.95	71.03		71.40	0.000165	4.89	426.32	32.00	0.22
Bypass to Coyote	124.366*	3530.00	55.95	73.06		73.88	0.000313	7.32	491.24	32.00	0.31
Bypass to Coyote	124.366*	4140.00	55.95	75.06		75.96	0.000295	7.66	555.17	32.00	0.31
Bypass to Coyote	124.366*	5360.00	55.95	77.07		78.30	0.000353	8.94	619.60	32.00	0.34
Bypass to Coyote	122.7	1130.00	55.95	69.01		69.16	0.000076	3.09	365.73	28.00	0.15
Bypass to Coyote	122.7	2070.00	55.95	71.03		71.40	0.000166	4.89	426.23	32.00	0.22
Bypass to Coyote	122.7	3530.00	55.95	73.05		73.88	0.000313	7.32	491.06	32.00	0.31
Bypass to Coyote	122.7	4140.00	55.95	75.05		75.95	0.000296	7.66	555.00	32.00	0.31
Bypass to Coyote	122.7	5360.00	55.95	77.06		78.29	0.000353	8.95	619.38	32.00	0.34
Bypass to Coyote	121.033*	1130.00	55.95	69.01		69.16	0.000076	3.09	365.69	28.00	0.15
Bypass to Coyote	121.033*	2070.00	55.95	71.02		71.39	0.000166	4.90	426.13	32.00	0.22
Bypass to Coyote	121.033*	3530.00	55.95	73.05		73.87	0.000313	7.32	490.87	32.00	0.31
Bypass to Coyote	121.033*	4140.00	55.95	75.04		75.95	0.000296	7.66	554.82	32.00	0.31
Bypass to Coyote	121.033*	5360.00	55.95	77.06		78.28	0.000354	8.95	619.16	32.00	0.34
Bypass to Coyote	119.366*	1130.00	55.95	69.01		69.16	0.000076	3.09	365.65	28.00	0.15
Bypass to Coyote	119.366*	2070.00	55.95	71.02		71.39	0.000166	4.90	426.04	32.00	0.22
Bypass to Coyote	119.366*	3530.00	55.95	73.04		73.87	0.000314	7.33	490.69	32.00	0.31
Bypass to Coyote	119.366*	4140.00	55.95	75.04		75.94	0.000296	7.66	554.64	32.00	0.31
Bypass to Coyote	119.366*	5360.00	55.95	77.05		78.28	0.000354	8.95	618.94	32.00	0.34
Bypass to Coyote	117.7	1130.00	55.95	69.01		69.16	0.000076	3.09	365.62	28.00	0.15
Bypass to Coyote	117.7	2070.00	55.95	71.02		71.39	0.000166	4.90	425.95	32.00	0.22
Bypass to Coyote	117.7	3530.00	55.95	73.03		73.86	0.000314	7.33	490.50	32.00	0.31
Bypass to Coyote	117.7	4140.00	55.95	75.03		75.94	0.000297	7.67	554.46	32.00	0.31
Bypass to Coyote	117.7	5360.00	55.95	77.04		78.27	0.000354	8.96	618.72	32.00	0.34
Bypass to Coyote	116.033*	1130.00	55.95	69.01		69.15	0.000076	3.09	365.58	28.00	0.15
Bypass to Coyote	116.033*	2070.00	55.95	71.01		71.39	0.000166	4.90	425.86	32.00	0.22
Bypass to Coyote	116.033*	3530.00	55.95	73.03		73.86	0.000315	7.33	490.32	32.00	0.31
Bypass to Coyote	116.033*	4140.00	55.95	75.03		75.93	0.000297	7.67	554.29	32.00	0.31
Bypass to Coyote	116.033*	5360.00	55.95	77.03		78.27	0.000355	8.96	618.50	32.00	0.34
Bypass to Coyote	114.366*	1130.00	55.95	69.01		69.15	0.000076	3.09	365.55	28.00	0.15
Bypass to Coyote	114.366*	2070.00	55.95	71.01		71.38	0.000166	4.90	425.77	32.00	0.22
Bypass to Coyote	114.366*	3530.00	55.95	73.02		73.85	0.000315	7.33	490.14	32.00	0.31
Bypass to Coyote	114.366*	4140.00	55.95	75.02		75.93	0.000297	7.67	554.11	32.00	0.31
Bypass to Coyote	114.366*	5360.00	55.95	77.03		78.26	0.000355	8.96	618.28	32.00	0.34

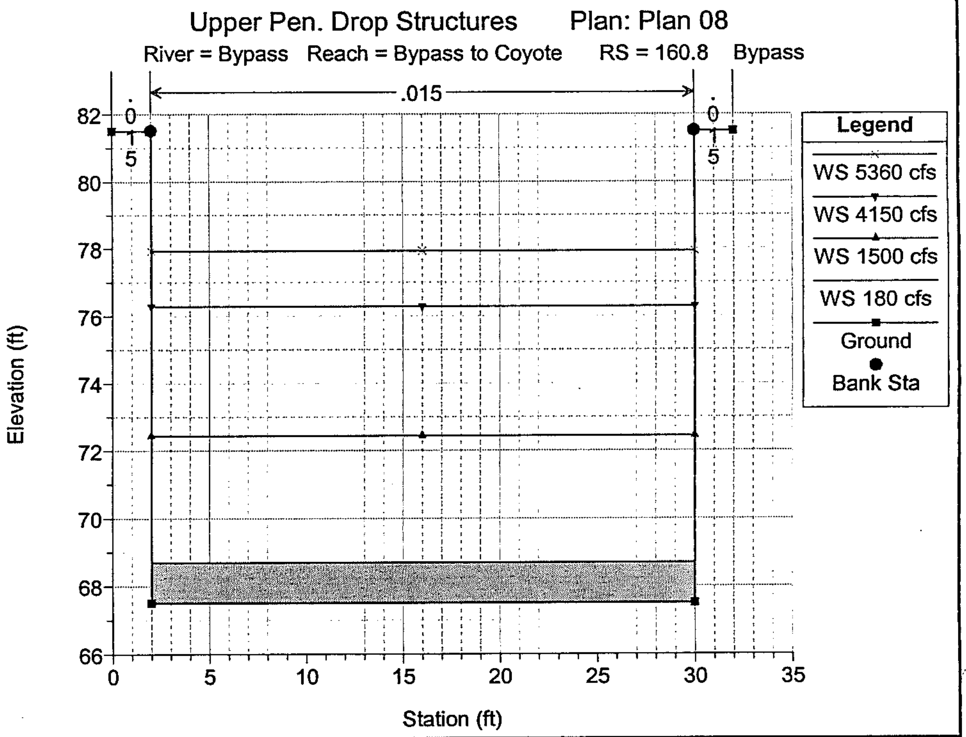
HEC-RAS Plan: Plan 02 River: Bypass Reach: Bypass to Coyote (Continued)

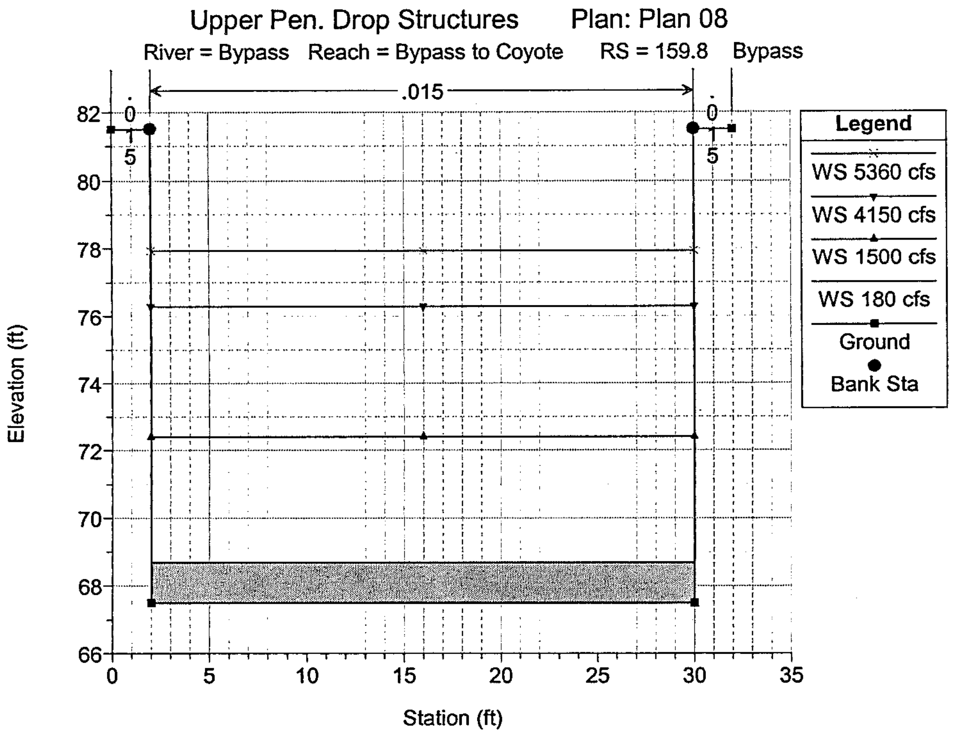
Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Bypass to Coyote	112.7	1130.00	55.95	69.00		69.15	0.000076	3.09	365.51	28.00	0.15
Bypass to Coyote	112.7	2070.00	55.95	71.01		71.38	0.000166	4.90	425.68	32.00	0.22
Bypass to Coyote	112.7	3530.00	55.95	73.02		73.85	0.000315	7.34	489.95	32.00	0.31
Bypass to Coyote	112.7	4140.00	55.95	75.02		75.92	0.000298	7.67	553.93	32.00	0.31
Bypass to Coyote	112.7	5360.00	55.95	77.02		78.25	0.000356	8.97	618.06	32.00	0.34
Bypass to Coyote	111.35*	1130.00	55.95	69.00		69.15	0.000076	3.09	365.47	28.00	0.15
Bypass to Coyote	111.35*	2070.00	55.95	71.01		71.38	0.000166	4.90	425.58	32.00	0.22
Bypass to Coyote	111.35*	3530.00	55.95	73.01		73.84	0.000316	7.34	489.77	32.00	0.31
Bypass to Coyote	111.35*	4140.00	55.95	75.01		75.92	0.000298	7.68	553.75	32.00	0.31
Bypass to Coyote	111.35*	5360.00	55.95	77.01		78.25	0.000356	8.97	617.84	32.00	0.34
Bypass to Coyote	110	1130.00	55.95	69.00		69.15	0.000076	3.09	365.44	28.00	0.15
Bypass to Coyote	110	2070.00	55.95	71.00		71.38	0.000166	4.90	425.49	32.00	0.22
Bypass to Coyote	110	3530.00	55.95	73.01		73.84	0.000316	7.34	489.58	32.00	0.31
Bypass to Coyote	110	4140.00	55.95	75.01		75.91	0.000298	7.68	553.58	32.00	0.31
Bypass to Coyote	110	5360.00	55.95	77.01		78.24	0.000356	8.97	617.62	32.00	0.34
Bypass to Coyote	108	1130.00	56.00	69.00		69.15	0.000077	3.10	364.00	28.00	0.15
Bypass to Coyote	108	2070.00	56.00	71.00		71.38	0.000168	4.92	424.00	32.00	0.22
Bypass to Coyote	108	3530.00	56.00	73.00		73.84	0.000319	7.37	488.00	32.00	0.31
Bypass to Coyote	108	4140.00	56.00	75.00		75.91	0.000300	7.70	552.00	32.00	0.31
Bypass to Coyote	108	5360.00	56.00	77.00		78.24	0.000359	9.00	616.00	32.00	0.35
Bypass to Coyote	106	1130.00	56.00	69.00		69.15	0.000077	3.10	364.00	28.00	0.15
Bypass to Coyote	106	2070.00	56.00	71.00		71.38	0.000168	4.92	424.00	32.00	0.22
Bypass to Coyote	106	3530.00	56.00	73.00		73.84	0.000319	7.37	488.00	32.00	0.31
Bypass to Coyote	106	4140.00	56.00	75.00		75.91	0.000300	7.70	552.00	32.00	0.31
Bypass to Coyote	106	5360.00	56.00	77.00		78.24	0.000359	9.00	616.00	32.00	0.35
Bypass to Coyote	104	1130.00	56.00	69.00		69.15	0.000077	3.10	364.00	28.00	0.15
Bypass to Coyote	104	2070.00	56.00	71.00		71.38	0.000168	4.92	424.00	32.00	0.22
Bypass to Coyote	104	3530.00	56.00	73.00		73.84	0.000319	7.37	488.00	32.00	0.31
Bypass to Coyote	104	4140.00	56.00	75.00		75.91	0.000300	7.70	552.00	32.00	0.31
Bypass to Coyote	104	5360.00	56.00	77.00		78.24	0.000359	9.00	616.00	32.00	0.35
Bypass to Coyote	102	1130.00	56.00	69.00		69.15	0.000077	3.10	364.00	28.00	0.15
Bypass to Coyote	102	2070.00	56.00	71.00		71.38	0.000168	4.92	424.00	32.00	0.22
Bypass to Coyote	102	3530.00	56.00	73.00		73.84	0.000319	7.37	488.00	32.00	0.31
Bypass to Coyote	102	4140.00	56.00	75.00		75.91	0.000300	7.70	552.00	32.00	0.31
Bypass to Coyote	102	5360.00	56.00	77.00		78.24	0.000359	9.00	616.00	32.00	0.35
Bypass to Coyote	100	1130.00	56.00	69.00	59.69	69.15	0.000077	3.10	364.00	28.00	0.15
Bypass to Coyote	100	2070.00	56.00	71.00	61.52	71.38	0.000168	4.92	424.00	32.00	0.22
Bypass to Coyote	100	3530.00	56.00	73.00	63.88	73.84	0.000319	7.37	488.00	32.00	0.31
Bypass to Coyote	100	4140.00	56.00	75.00	64.76	75.91	0.000300	7.70	552.00	32.00	0.31
Bypass to Coyote	100	5360.00	56.00	77.00	66.43	78.24	0.000359	9.00	616.00	32.00	0.35


Upper Pen. Drop Structures Plan: Plan 08
River = Bypass Reach = Bypass to Coyote RS = 167.7 Bypass

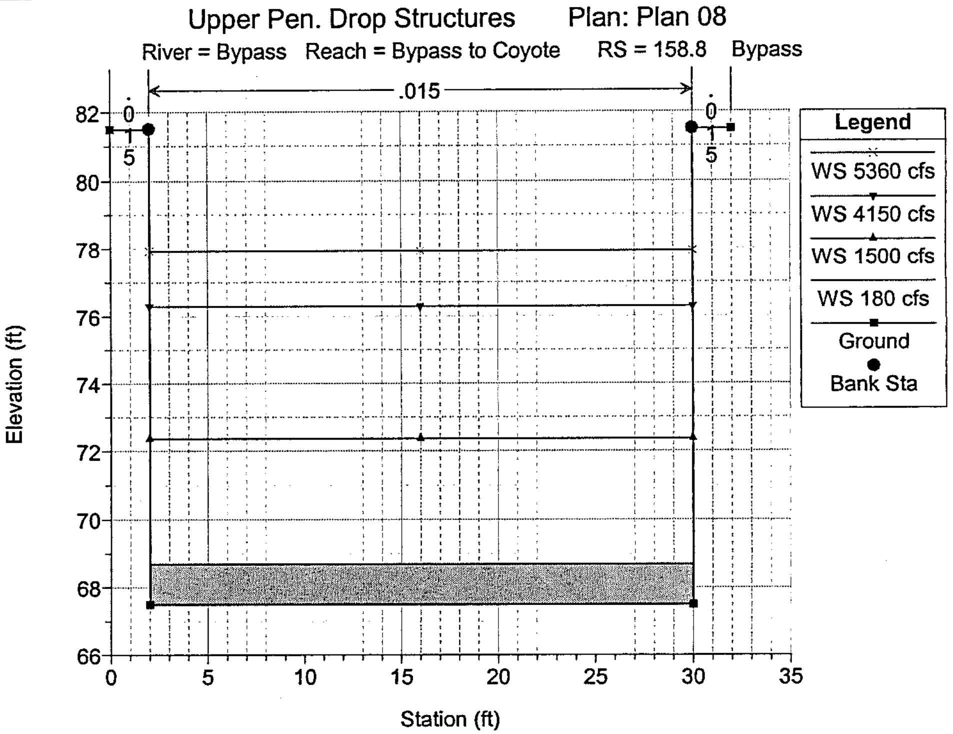

Upper Pen. Drop Structures Plan: Plan 08
River = Bypass Reach = Bypass to Coyote RS = 162.8 Bypass


Upper Pen. Drop Structures Plan: Plan 08
River = Bypass Reach = Bypass to Coyote RS = 161.8 Bypass

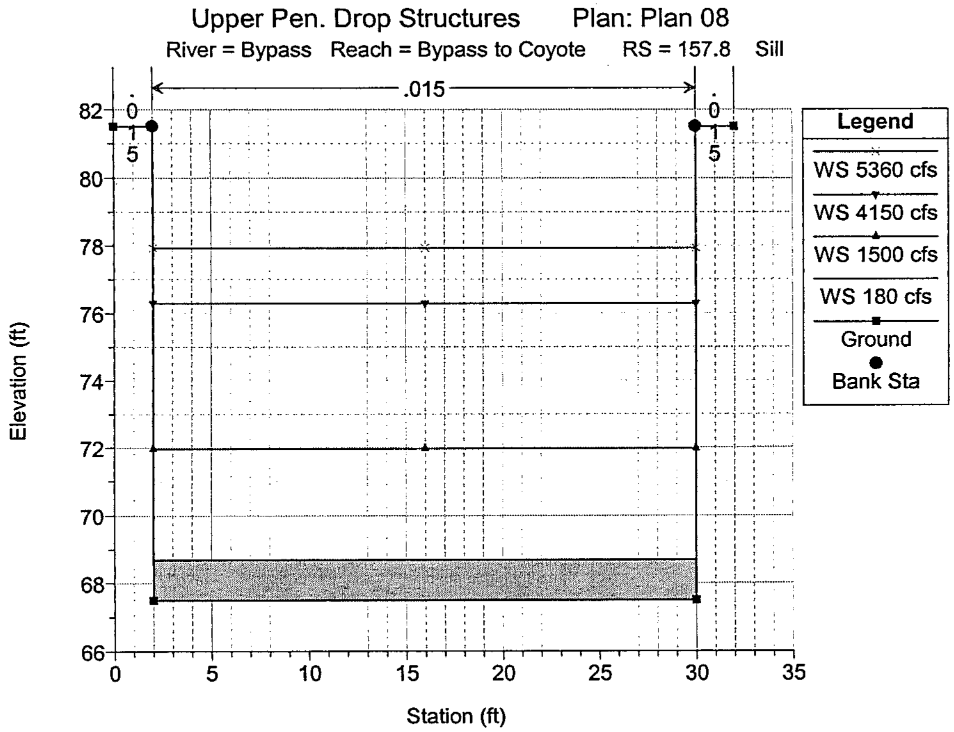

Upper Pen. Drop Structures Plan: Plan 08
River = Bypass Reach = Bypass to Coyote RS = 160.8 Bypass



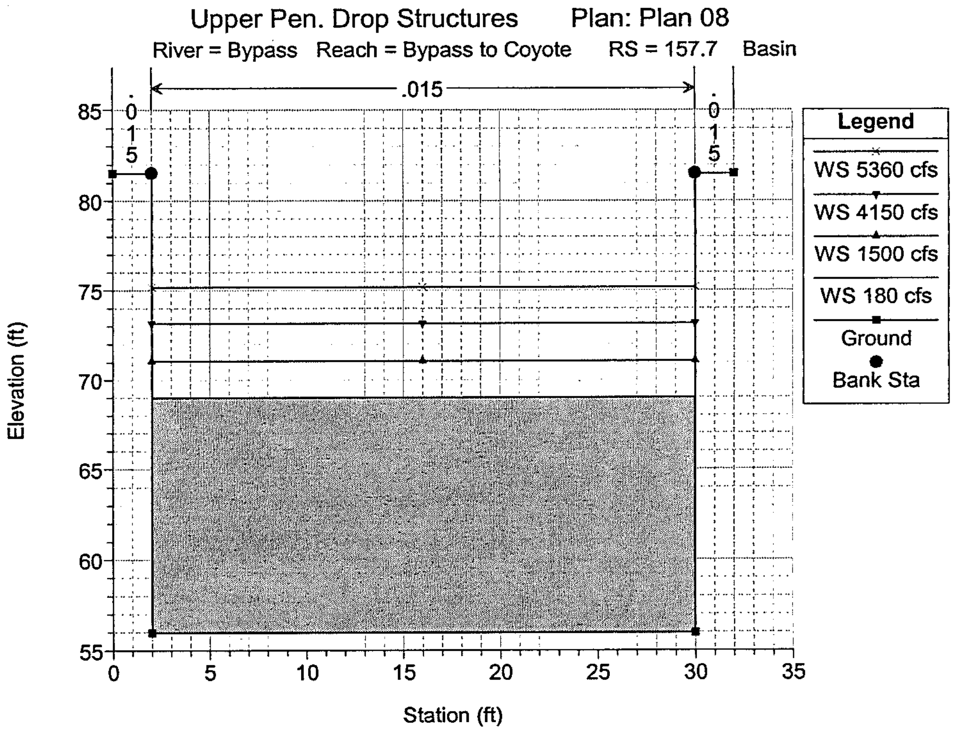
Upper Pen. Drop Structures Plan: Plan 08
River = Bypass Reach = Bypass to Coyote RS = 159.8 Bypass



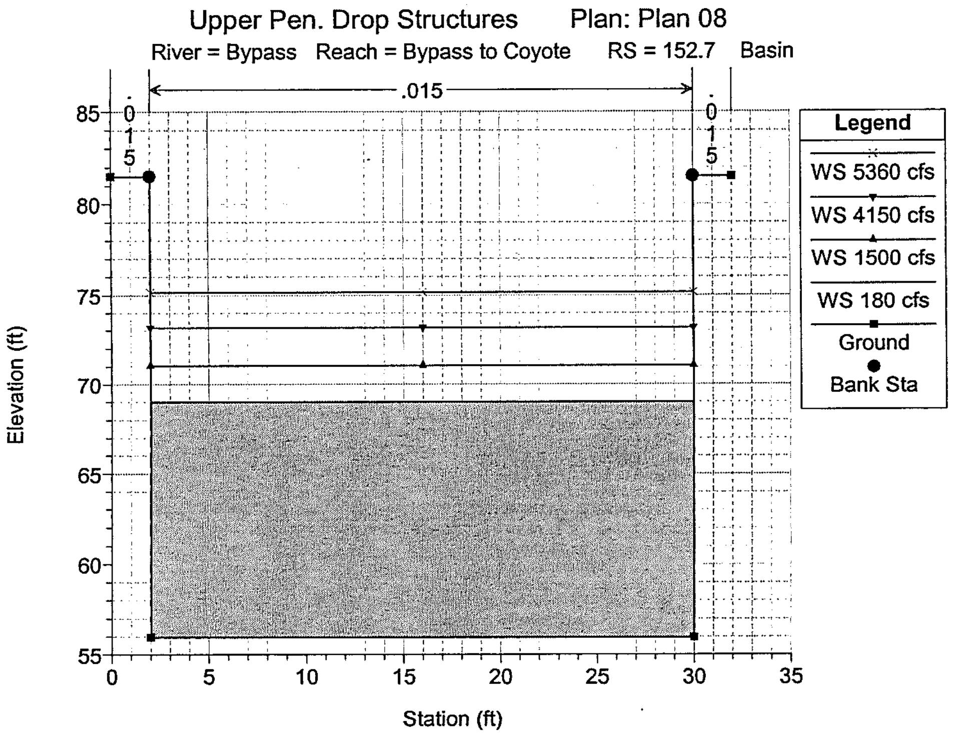
Upper Pen. Drop Structures Plan: Plan 08
River = Bypass Reach = Bypass to Coyote RS = 158.8 Bypass

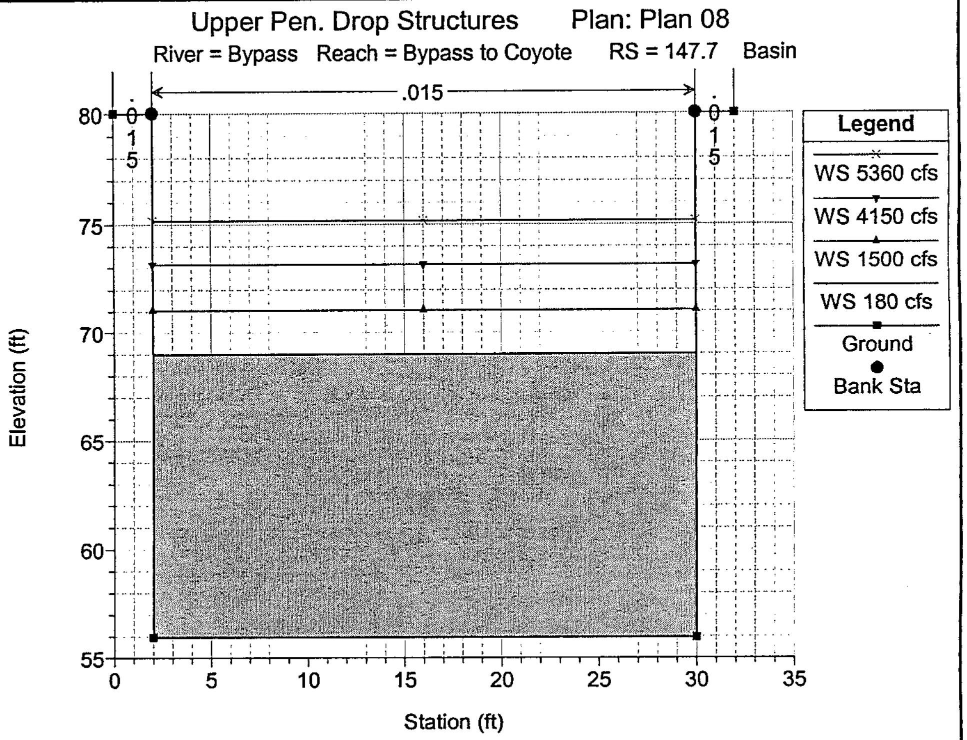


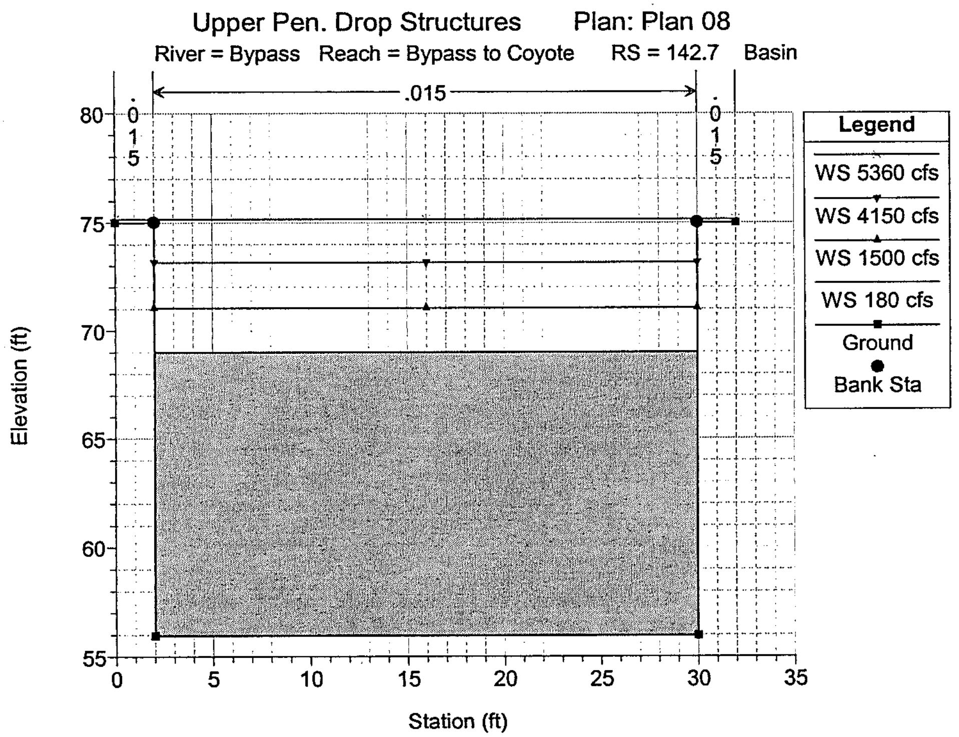
Upper Pen. Drop Structures Plan: Plan 08
River = Bypass Reach = Bypass to Coyote RS = 157.8 Sill

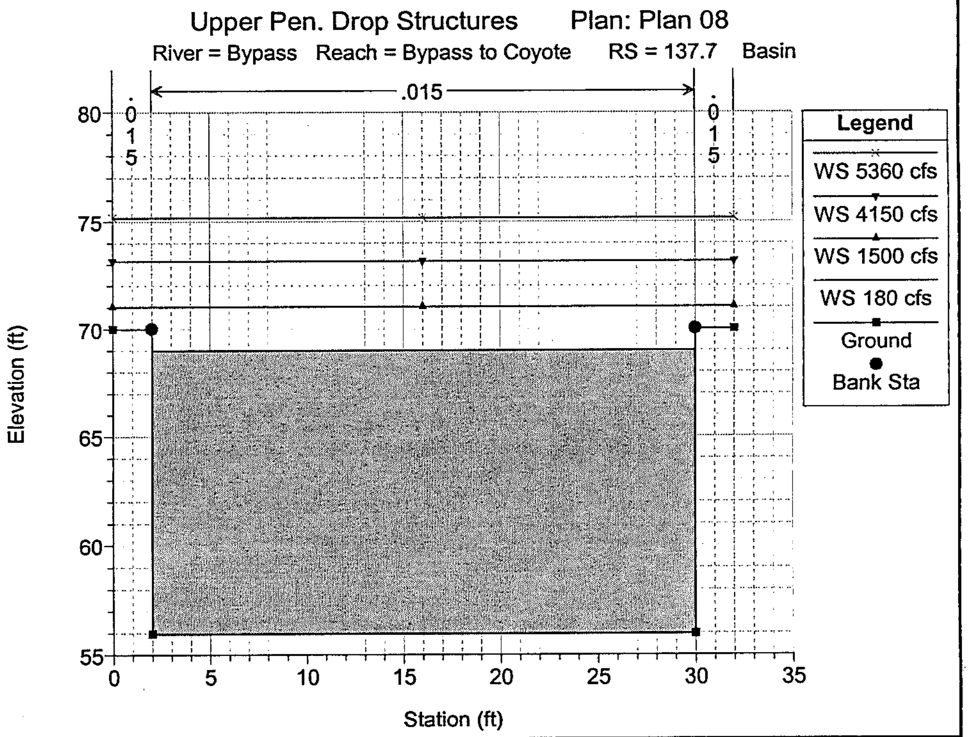


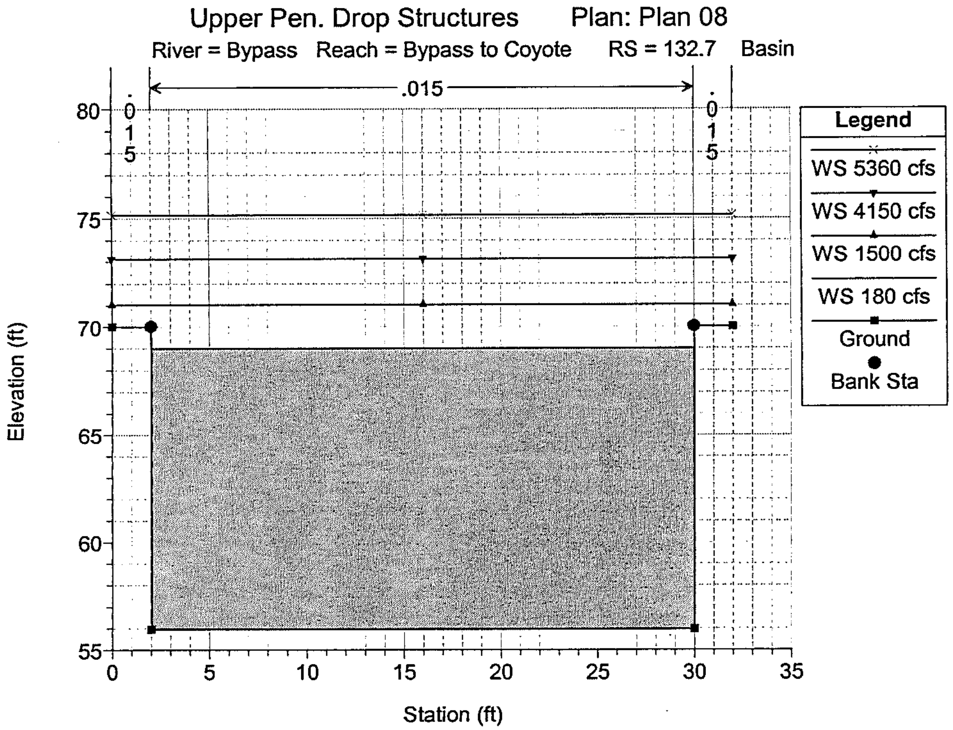
Upper Pen. Drop Structures Plan: Plan 08
River = Bypass Reach = Bypass to Coyote RS = 157.7 Basin

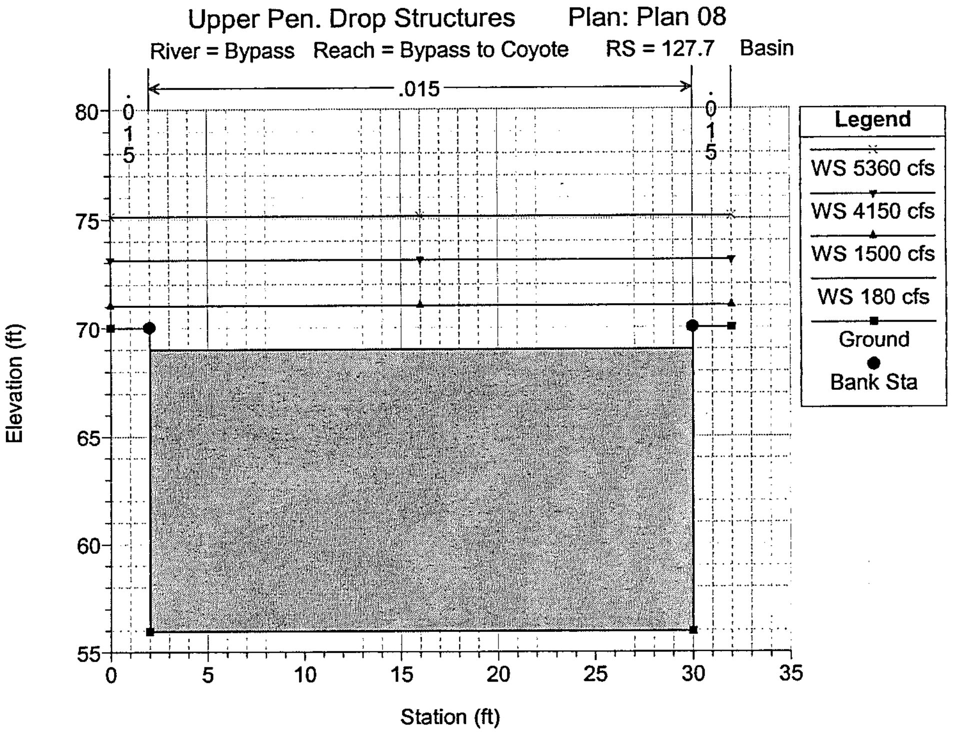

Upper Pen. Drop Structures Plan: Plan 08
River = Bypass Reach = Bypass to Coyote RS = 152.7 Basin
.015
.015
.015
Legend
WS 5360 cfs
WS 4150 cfs
WS 1500 cfs
WS 180 cfs
Ground
Bank Sta
Elevation (ft)
85
80
75
70
65
60
55
0
5
10
15
20
25
30
35
Station (ft)

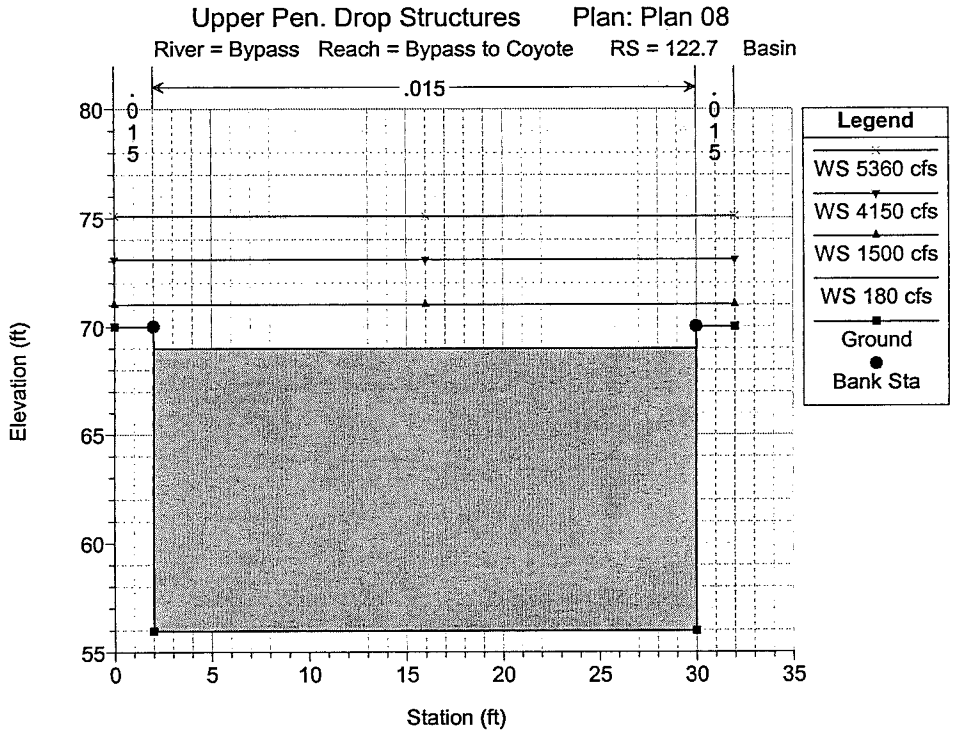

Upper Pen. Drop Structures Plan: Plan 08
River = Bypass Reach = Bypass to Coyote RS = 147.7 Basin
.015
.015
.015
Legend
WS 5360 cfs
WS 4150 cfs
WS 1500 cfs
WS 180 cfs
Ground
Bank Sta
Elevation (ft)
80
75
70
65
60
55
0
5
10
15
20
25
30
35
Station (ft)

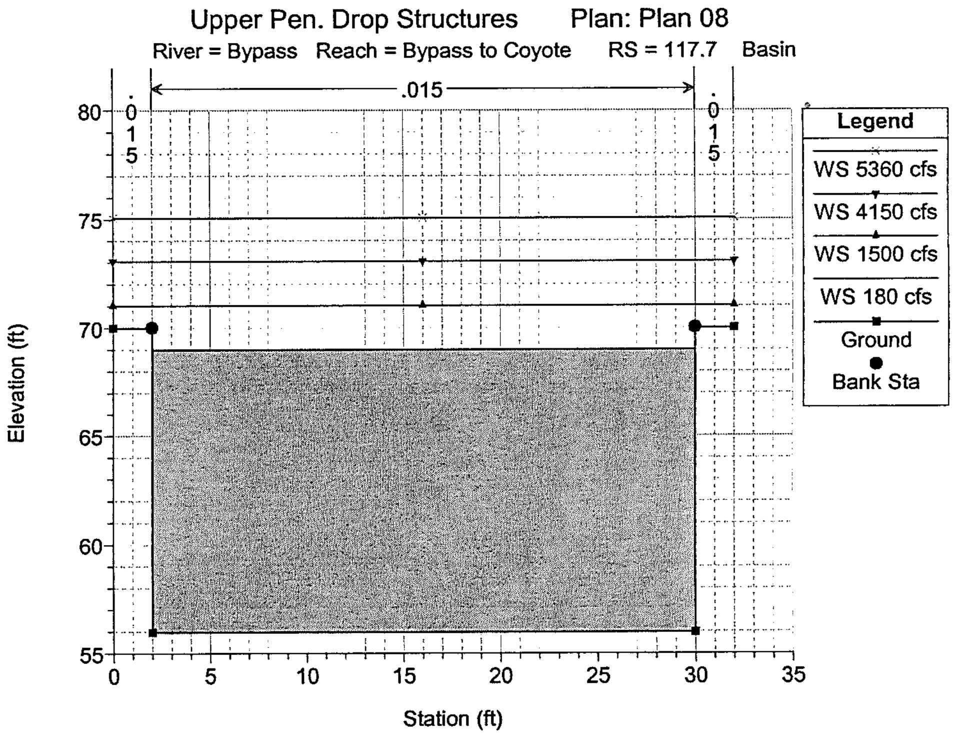

Upper Pen. Drop Structures Plan: Plan 08
River = Bypass Reach = Bypass to Coyote RS = 142.7 Basin
.015
.015
.015
Legend
WS 5360 cfs
WS 4150 cfs
WS 1500 cfs
WS 180 cfs
Ground
Bank Sta
Elevation (ft)
80
75
70
65
60
55
0
5
10
15
20
25
30
35
Station (ft)

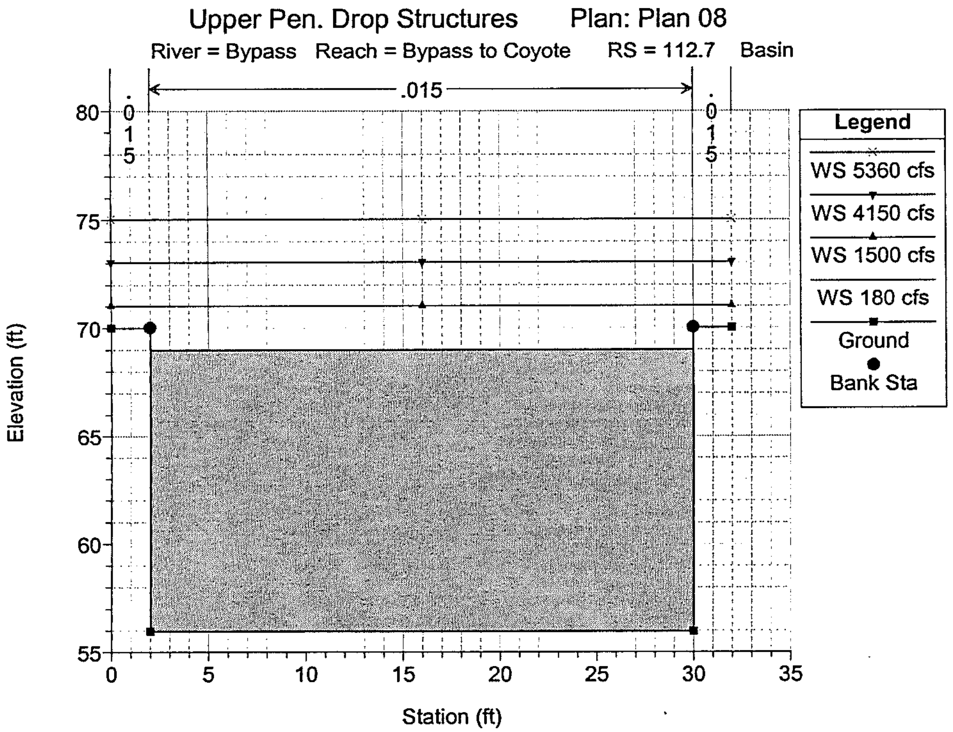

Upper Pen. Drop Structures Plan: Plan 08
River = Bypass Reach = Bypass to Coyote RS = 137.7 Basin
.015
.015
.015
Legend
WS 5360 cfs
WS 4150 cfs
WS 1500 cfs
WS 180 cfs
Ground
Bank Sta
Elevation (ft)
80
75
70
65
60
55
0
5
10
15
20
25
30
35
Station (ft)

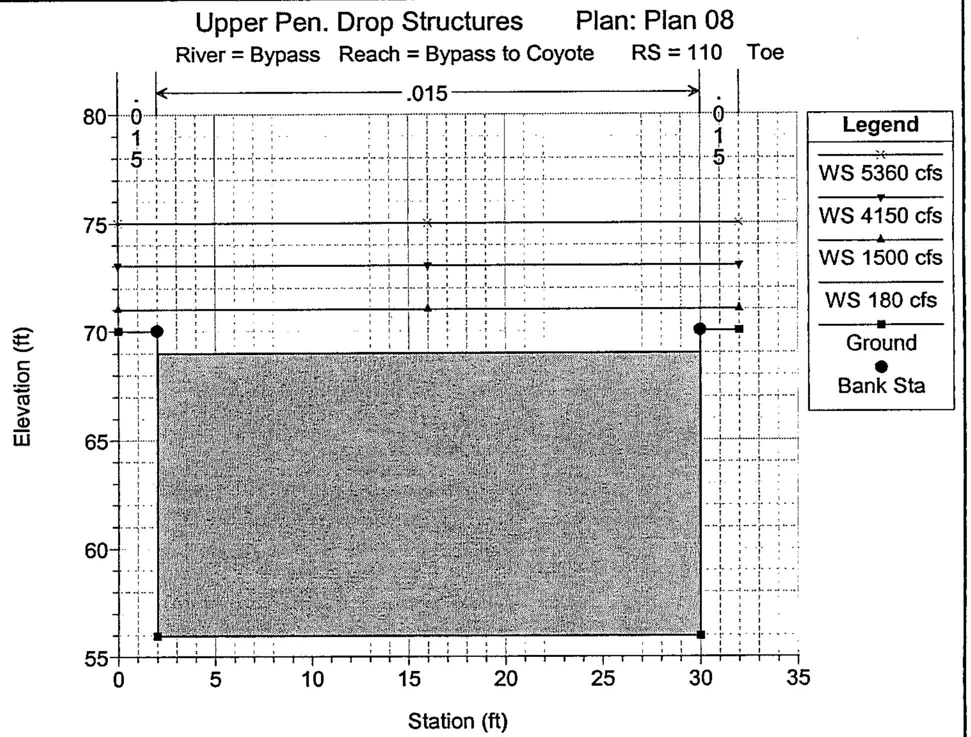

Upper Pen. Drop Structures Plan: Plan 08
River = Bypass Reach = Bypass to Coyote RS = 132.7 Basin
.015
.015
.015
Elevation (ft)
Station (ft)
55
60
65
70
75
80
0
5
10
15
20
25
30
35
Legend
WS 5360 cfs
WS 4150 cfs
WS 1500 cfs
WS 180 cfs
Ground
Bank Sta

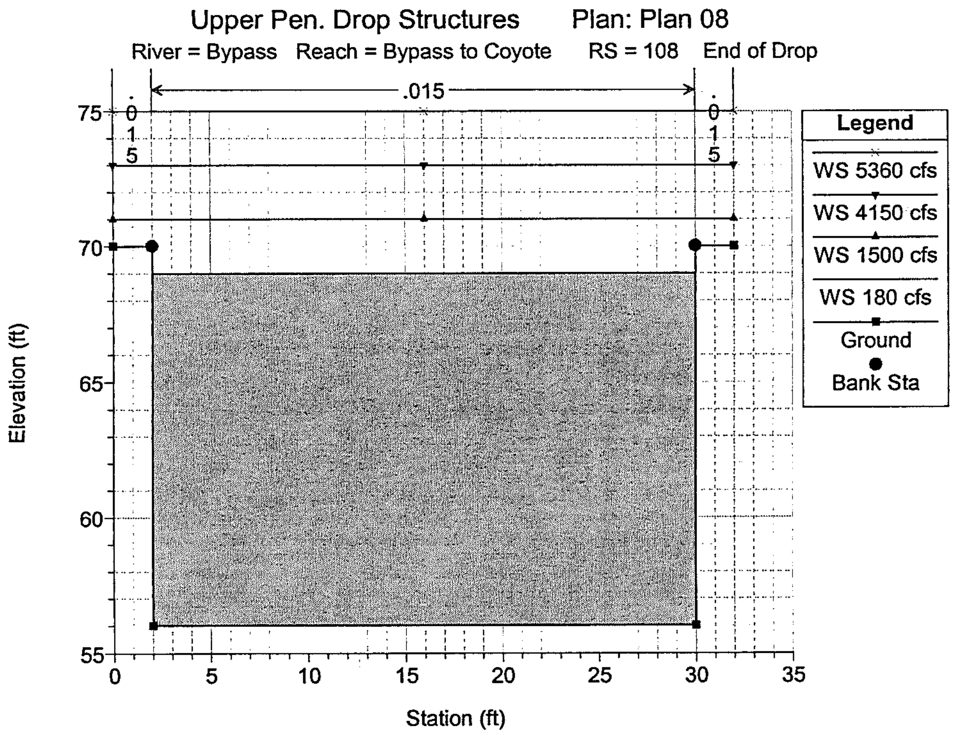

Upper Pen. Drop Structures Plan: Plan 08
River = Bypass Reach = Bypass to Coyote RS = 127.7 Basin
.015
.015
.015
Elevation (ft)
Station (ft)
55
60
65
70
75
80
0
5
10
15
20
25
30
35
Legend
WS 5360 cfs
WS 4150 cfs
WS 1500 cfs
WS 180 cfs
Ground
Bank Sta

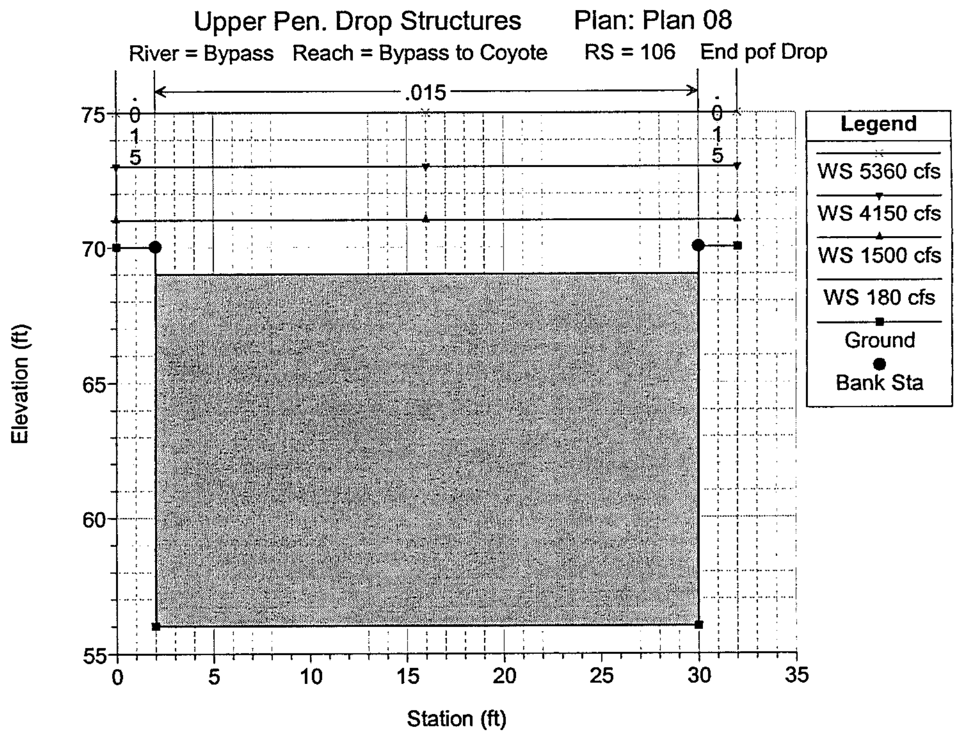

Upper Pen. Drop Structures Plan: Plan 08
River = Bypass Reach = Bypass to Coyote RS = 122.7 Basin
.015
.015
.015
Elevation (ft)
Station (ft)
55
60
65
70
75
80
0
5
10
15
20
25
30
35
Legend
WS 5360 cfs
WS 4150 cfs
WS 1500 cfs
WS 180 cfs
Ground
Bank Sta

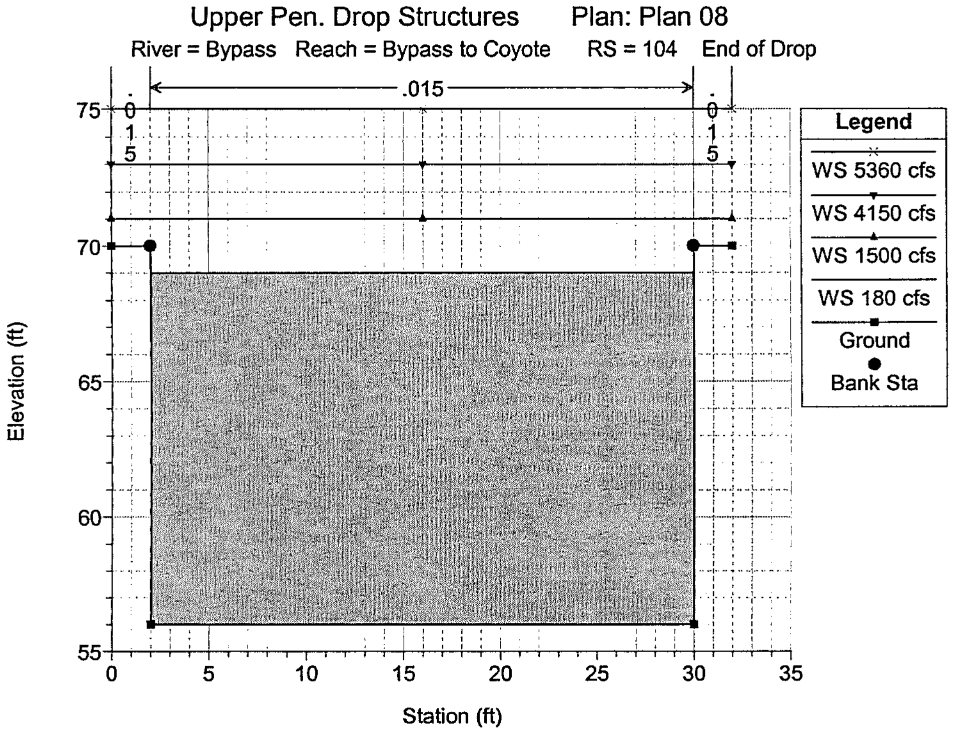

Upper Pen. Drop Structures Plan: Plan 08
River = Bypass Reach = Bypass to Coyote RS = 117.7 Basin
.015
.015
.015
Elevation (ft)
Station (ft)
55
60
65
70
75
80
0
5
10
15
20
25
30
35
Legend
WS 5360 cfs
WS 4150 cfs
WS 1500 cfs
WS 180 cfs
Ground
Bank Sta

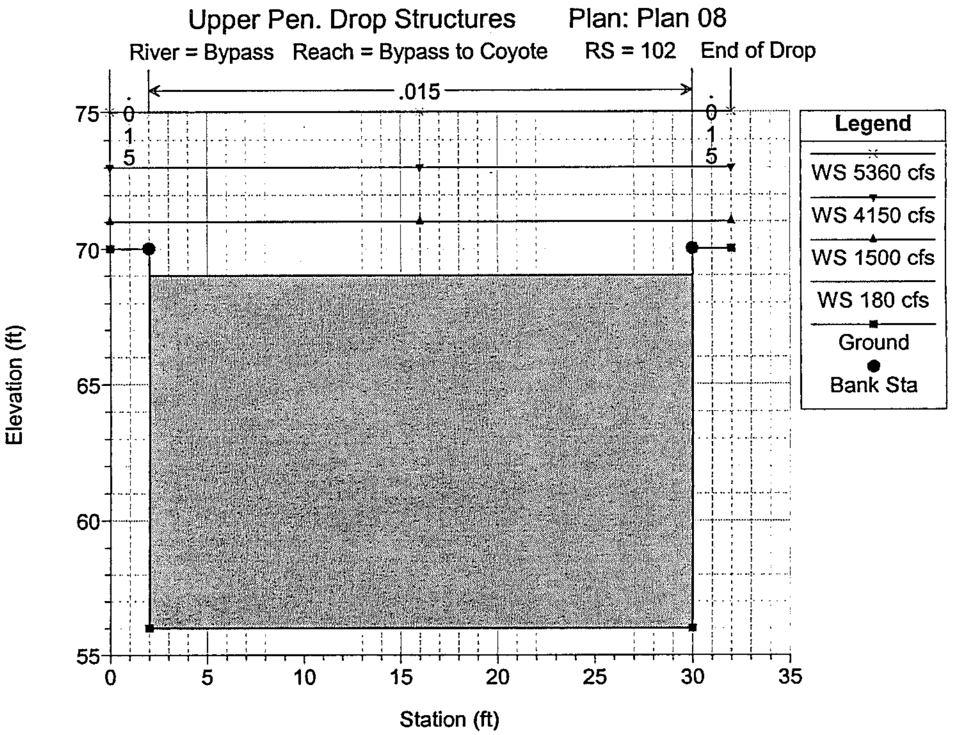

Upper Pen. Drop Structures Plan: Plan 08
River = Bypass Reach = Bypass to Coyote RS = 112.7 Basin
.015
.015
.015
Legend
WS 5360 cfs
WS 4150 cfs
WS 1500 cfs
WS 180 cfs
Ground
Bank Sta
Elevation (ft)
80
75
70
65
60
55
Station (ft)
0
5
10
15
20
25
30
35

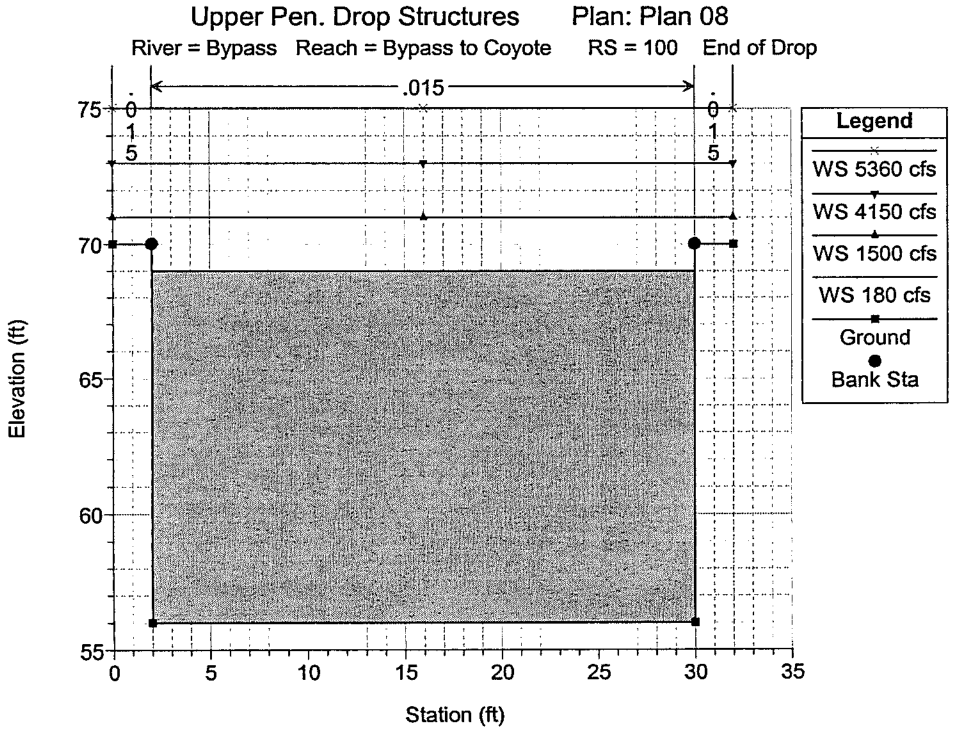

Upper Pen. Drop Structures Plan: Plan 08
River = Bypass Reach = Bypass to Coyote RS = 110 Toe
.015
.015
.015
Legend
WS 5360 cfs
WS 4150 cfs
WS 1500 cfs
WS 180 cfs
Ground
Bank Sta
Elevation (ft)
80
75
70
65
60
55
Station (ft)
0
5
10
15
20
25
30
35


Upper Pen. Drop Structures Plan: Plan 08
River = Bypass Reach = Bypass to Coyote RS = 108 End of Drop
.015
.015
.015
Legend
WS 5360 cfs
WS 4150 cfs
WS 1500 cfs
WS 180 cfs
Ground
Bank Sta
Elevation (ft)
75
70
65
60
55
Station (ft)
0
5
10
15
20
25
30
35


Upper Pen. Drop Structures Plan: Plan 08
River = Bypass Reach = Bypass to Coyote RS = 106 End pof Drop
.015
.015
.015
Legend
WS 5360 cfs
WS 4150 cfs
WS 1500 cfs
WS 180 cfs
Ground
Bank Sta
Elevation (ft)
75
70
65
60
55
Station (ft)
0
5
10
15
20
25
30
35

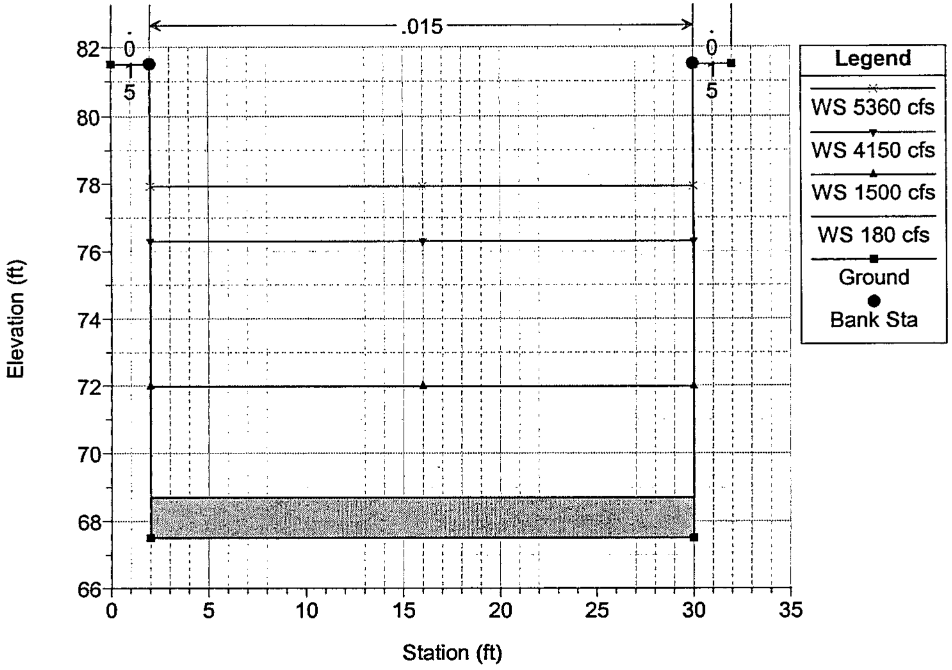

Upper Pen. Drop Structures Plan: Plan 08
River = Bypass Reach = Bypass to Coyote RS = 104 End of Drop
.015
.015
.015
Legend
WS 5360 cfs
WS 4150 cfs
WS 1500 cfs
WS 180 cfs
Ground
Bank Sta
Elevation (ft)
75
70
65
60
55
Station (ft)
0
5
10
15
20
25
30
35


Upper Pen. Drop Structures Plan: Plan 08
River = Bypass Reach = Bypass to Coyote RS = 102 End of Drop
.015
.015
.015
Legend
WS 5360 cfs
WS 4150 cfs
WS 1500 cfs
WS 180 cfs
Ground
Bank Sta
Elevation (ft)
75
70
65
60
55
Station (ft)
0
5
10
15
20
25
30
35


Upper Pen. Drop Structures Plan: Plan 08
River = Bypass Reach = Bypass to Coyote RS = 100 End of Drop
.015
.015
.015
Legend
WS 5360 cfs
WS 4150 cfs
WS 1500 cfs
WS 180 cfs
Ground
Bank Sta
Elevation (ft)
75
70
65
60
55
Station (ft)
0
5
10
15
20
25
30
35

Upper Pen. Drop Structures Plan: Plan 09

River = Bypass Reach = Bypass to Coyote RS = 167.7 Bypass



Drop Structure at Bypass Outlet with Rip-Rap

HEC-RAS Plan: Plan 05 River: Bypass Reach: Bypass to Coyote

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Bypass to Coyote	167.7	690.00	67.50	70.15	70.15	71.49	0.003018	9.29	74.27	28.00	1.01
Bypass to Coyote	167.7	1310.00	67.50	72.19		73.74	0.001895	9.97	131.41	28.00	0.81
Bypass to Coyote	167.7	2950.00	67.50	74.49	74.49	78.02	0.002971	15.07	195.74	28.00	1.00
Bypass to Coyote	167.7	4150.00	67.50	76.30	76.30	80.70	0.003052	16.85	246.29	28.00	1.00
Bypass to Coyote	167.7	5360.00	67.50	77.93	77.93	83.16	0.003166	18.36	292.01	28.00	1.00
Bypass to Coyote	166.066*	690.00	67.50	70.15	70.15	71.49	0.003018	9.29	74.27	28.00	1.01
Bypass to Coyote	166.066*	1310.00	67.50	72.15		73.72	0.001944	10.05	130.29	28.00	0.82
Bypass to Coyote	166.066*	2950.00	67.50	74.49	74.49	78.02	0.002971	15.07	195.74	28.00	1.00
Bypass to Coyote	166.066*	4150.00	67.50	76.30	76.30	80.70	0.003053	16.85	246.29	28.00	1.00
Bypass to Coyote	166.066*	5360.00	67.50	77.93	77.93	83.16	0.003166	18.36	292.01	28.00	1.00
Bypass to Coyote	164.433*	690.00	67.50	70.15	70.15	71.49	0.003018	9.29	74.27	28.00	1.01
Bypass to Coyote	164.433*	1310.00	67.50	72.11		73.71	0.001995	10.14	129.18	28.00	0.83
Bypass to Coyote	164.433*	2950.00	67.50	74.49	74.49	78.02	0.002971	15.07	195.74	28.00	1.00
Bypass to Coyote	164.433*	4150.00	67.50	76.30	76.30	80.70	0.003053	16.85	246.28	28.00	1.00
Bypass to Coyote	164.433*	5360.00	67.50	77.93	77.93	83.16	0.003166	18.36	292.00	28.00	1.00
Bypass to Coyote	162.8	690.00	67.50	70.15	70.15	71.49	0.003018	9.29	74.27	28.00	1.01
Bypass to Coyote	162.8	1310.00	67.50	72.07		73.70	0.002048	10.23	128.06	28.00	0.84
Bypass to Coyote	162.8	2950.00	67.50	74.49	74.49	78.02	0.002971	15.07	195.74	28.00	1.00
Bypass to Coyote	162.8	4150.00	67.50	76.30	76.30	80.70	0.003053	16.85	246.28	28.00	1.00
Bypass to Coyote	162.8	5360.00	67.50	77.93	77.93	83.16	0.003166	18.36	292.00	28.00	1.00
Bypass to Coyote	161.8	690.00	67.50	70.15	70.15	71.49	0.003018	9.29	74.27	28.00	1.01
Bypass to Coyote	161.8	1310.00	67.50	72.03		73.69	0.002102	10.32	126.94	28.00	0.85
Bypass to Coyote	161.8	2950.00	67.50	74.49	74.49	78.02	0.002971	15.07	195.74	28.00	1.00
Bypass to Coyote	161.8	4150.00	67.50	76.30	76.30	80.70	0.003053	16.85	246.26	28.00	1.00
Bypass to Coyote	161.8	5360.00	67.50	77.93	77.93	83.16	0.003166	18.36	291.99	28.00	1.00
Bypass to Coyote	160.8	690.00	67.50	70.15	70.15	71.49	0.003018	9.29	74.27	28.00	1.01
Bypass to Coyote	160.8	1310.00	67.50	71.99		73.68	0.002159	10.41	125.82	28.00	0.87
Bypass to Coyote	160.8	2950.00	67.50	74.49	74.49	78.02	0.002971	15.07	195.74	28.00	1.00
Bypass to Coyote	160.8	4150.00	67.50	76.29	76.29	80.70	0.003054	16.85	246.25	28.00	1.00
Bypass to Coyote	160.8	5360.00	67.50	77.93	77.93	83.16	0.003166	18.36	291.98	28.00	1.00
Bypass to Coyote	159.8	690.00	67.50	70.15	70.15	71.49	0.003018	9.29	74.27	28.00	1.01
Bypass to Coyote	159.8	1310.00	67.50	71.95		73.67	0.002218	10.50	124.71	28.00	0.88
Bypass to Coyote	159.8	2950.00	67.50	74.49	74.49	78.02	0.002971	15.07	195.74	28.00	1.00
Bypass to Coyote	159.8	4150.00	67.50	76.29	76.29	80.70	0.003055	16.86	246.22	28.00	1.00
Bypass to Coyote	159.8	5360.00	67.50	77.93	77.93	83.16	0.003167	18.36	291.96	28.00	1.00
Bypass to Coyote	158.8	690.00	67.50	70.15	70.15	71.49	0.003018	9.29	74.27	28.00	1.01
Bypass to Coyote	158.8	1310.00	67.50	71.91		73.66	0.002279	10.60	123.59	28.00	0.89
Bypass to Coyote	158.8	2950.00	67.50	74.49	74.49	78.02	0.002971	15.07	195.74	28.00	1.00
Bypass to Coyote	158.8	4150.00	67.50	76.29	76.29	80.70	0.003057	16.86	246.17	28.00	1.00
Bypass to Coyote	158.8	5360.00	67.50	77.93	77.93	83.16	0.003168	18.36	291.93	28.00	1.00
Bypass to Coyote	157.8	690.00	67.50	70.15	70.15	71.49	0.003018	9.29	74.27	28.00	1.01
Bypass to Coyote	157.8	1310.00	67.50	71.57	71.57	73.62	0.002915	11.50	113.92	28.00	1.00
Bypass to Coyote	157.8	2950.00	67.50	74.49	74.49	78.02	0.002973	15.07	195.70	28.00	1.00
Bypass to Coyote	157.8	4150.00	67.50	76.29	76.29	80.70	0.003059	16.86	246.10	28.00	1.00
Bypass to Coyote	157.8	5360.00	67.50	77.92	77.92	83.16	0.003169	18.36	291.88	28.00	1.00
Bypass to Coyote	157.7	690.00	55.95	68.99		69.05	0.000029	1.89	365.19	28.00	0.09
Bypass to Coyote	157.7	1310.00	55.95	70.95		71.10	0.000071	3.12	419.93	28.00	0.14
Bypass to Coyote	157.7	2950.00	55.95	72.77		73.38	0.000266	6.26	471.07	28.00	0.27
Bypass to Coyote	157.7	4150.00	55.95	74.54		75.53	0.000406	7.97	520.47	28.00	0.33
Bypass to Coyote	157.7	5360.00	55.95	76.35		77.72	0.000534	9.38	571.29	28.00	0.37
Bypass to Coyote	156.033*	690.00	55.95	68.99		69.05	0.000029	1.89	365.17	28.00	0.09
Bypass to Coyote	156.033*	1310.00	55.95	70.95		71.10	0.000071	3.12	419.89	28.00	0.14
Bypass to Coyote	156.033*	2950.00	55.95	72.77		73.38	0.000266	6.26	470.95	28.00	0.27
Bypass to Coyote	156.033*	4150.00	55.95	74.54		75.53	0.000406	7.97	520.46	28.00	0.33
Bypass to Coyote	156.033*	5360.00	55.95	76.35		77.72	0.000534	9.38	571.28	28.00	0.37
Bypass to Coyote	154.366*	690.00	55.95	68.99		69.05	0.000029	1.89	365.16	28.00	0.09
Bypass to Coyote	154.366*	1310.00	55.95	70.95		71.10	0.000071	3.12	419.86	28.00	0.14
Bypass to Coyote	154.366*	2950.00	55.95	72.77		73.37	0.000266	6.27	470.83	28.00	0.27
Bypass to Coyote	154.366*	4150.00	55.95	74.54		75.52	0.000406	7.97	520.45	28.00	0.33
Bypass to Coyote	154.366*	5360.00	55.95	76.35		77.72	0.000534	9.38	571.27	28.00	0.37

HEC-RAS Plan: Plan 05 River: Bypass Reach: Bypass to Coyote (Continued)

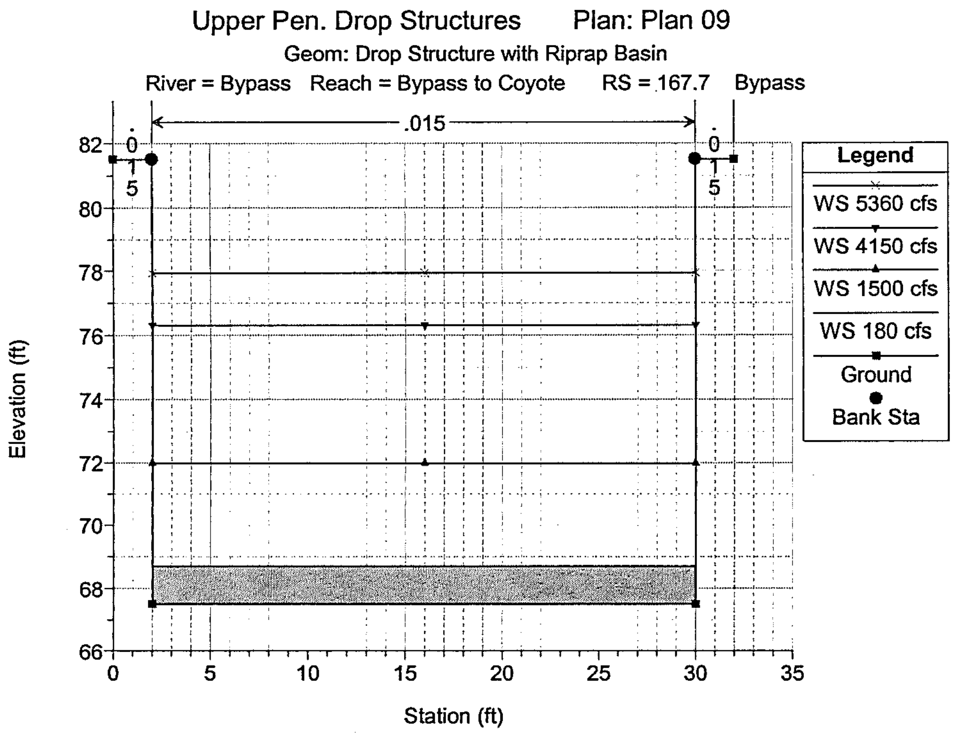
Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Bypass to Coyote	152.7	690.00	55.95	68.99		69.05	0.000029	1.89	365.15	28.00	0.09
Bypass to Coyote	152.7	1310.00	55.95	70.94		71.10	0.000071	3.12	419.83	28.00	0.14
Bypass to Coyote	152.7	2950.00	55.95	72.76		73.37	0.000266	6.27	470.71	28.00	0.27
Bypass to Coyote	152.7	4150.00	55.95	74.54		75.52	0.000406	7.97	520.44	28.00	0.33
Bypass to Coyote	152.7	5360.00	55.95	76.35		77.72	0.000534	9.38	571.25	28.00	0.37
Bypass to Coyote	151.033*	690.00	55.95	68.99		69.05	0.000029	1.89	365.13	28.00	0.09
Bypass to Coyote	151.033*	1310.00	55.95	70.94		71.09	0.000071	3.12	419.79	28.00	0.14
Bypass to Coyote	151.033*	2950.00	55.95	72.76		73.37	0.000266	6.27	470.59	28.00	0.27
Bypass to Coyote	151.033*	4150.00	55.95	74.54		75.52	0.000406	7.97	520.43	28.00	0.33
Bypass to Coyote	151.033*	5360.00	55.95	76.35		77.72	0.000534	9.38	571.24	28.00	0.37
Bypass to Coyote	149.366*	690.00	55.95	68.99		69.05	0.000029	1.89	365.12	28.00	0.09
Bypass to Coyote	149.366*	1310.00	55.95	70.94		71.09	0.000071	3.12	419.76	28.00	0.14
Bypass to Coyote	149.366*	2950.00	55.95	72.75		73.36	0.000266	6.27	470.46	28.00	0.27
Bypass to Coyote	149.366*	4150.00	55.95	74.54		75.52	0.000406	7.97	520.43	28.00	0.33
Bypass to Coyote	149.366*	5360.00	55.95	76.35		77.72	0.000534	9.38	571.23	28.00	0.37
Bypass to Coyote	147.7	690.00	55.95	68.99		69.04	0.000029	1.89	365.11	28.00	0.09
Bypass to Coyote	147.7	1310.00	55.95	70.94		71.09	0.000071	3.12	419.73	28.00	0.14
Bypass to Coyote	147.7	2950.00	55.95	72.75		73.36	0.000267	6.27	470.34	28.00	0.27
Bypass to Coyote	147.7	4150.00	55.95	74.54		75.52	0.000406	7.97	520.42	28.00	0.33
Bypass to Coyote	147.7	5360.00	55.95	76.35		77.72	0.000534	9.38	571.22	28.00	0.37
Bypass to Coyote	146.033*	690.00	55.95	68.99		69.04	0.000029	1.89	365.09	28.00	0.09
Bypass to Coyote	146.033*	1310.00	55.95	70.94		71.09	0.000071	3.12	419.70	28.00	0.14
Bypass to Coyote	146.033*	2950.00	55.95	72.74		73.35	0.000267	6.27	470.22	28.00	0.27
Bypass to Coyote	146.033*	4150.00	55.95	74.54		75.52	0.000406	7.97	520.41	28.00	0.33
Bypass to Coyote	146.033*	5360.00	55.95	76.35		77.72	0.000534	9.38	571.20	28.00	0.37
Bypass to Coyote	144.366*	690.00	55.95	68.99		69.04	0.000029	1.89	365.08	28.00	0.09
Bypass to Coyote	144.366*	1310.00	55.95	70.94		71.09	0.000071	3.12	419.66	28.00	0.14
Bypass to Coyote	144.366*	2950.00	55.95	72.74		73.35	0.000267	6.28	470.10	28.00	0.27
Bypass to Coyote	144.366*	4150.00	55.95	74.54		75.52	0.000406	7.97	520.40	28.00	0.33
Bypass to Coyote	144.366*	5360.00	55.95	76.35		77.72	0.000534	9.38	571.19	28.00	0.37
Bypass to Coyote	142.7	690.00	55.95	68.99		69.04	0.000029	1.89	365.07	28.00	0.09
Bypass to Coyote	142.7	1310.00	55.95	70.94		71.09	0.000071	3.12	419.63	28.00	0.14
Bypass to Coyote	142.7	2950.00	55.95	72.73		73.35	0.000267	6.28	469.98	28.00	0.27
Bypass to Coyote	142.7	4150.00	55.95	74.54		75.52	0.000406	7.97	520.39	28.00	0.33
Bypass to Coyote	142.7	5360.00	55.95	76.35		77.71	0.000504	9.36	576.68	32.00	0.37
Bypass to Coyote	141.033*	690.00	55.95	68.99		69.04	0.000029	1.89	365.05	28.00	0.09
Bypass to Coyote	141.033*	1310.00	55.95	70.94		71.09	0.000071	3.12	419.60	28.00	0.14
Bypass to Coyote	141.033*	2950.00	55.95	72.73		73.34	0.000267	6.28	469.86	28.00	0.27
Bypass to Coyote	141.033*	4150.00	55.95	74.54		75.52	0.000385	7.96	525.31	32.00	0.33
Bypass to Coyote	141.033*	5360.00	55.95	76.36		77.70	0.000467	9.33	583.45	32.00	0.36
Bypass to Coyote	139.366*	690.00	55.95	68.99		69.04	0.000029	1.89	365.04	28.00	0.09
Bypass to Coyote	139.366*	1310.00	55.95	70.93		71.09	0.000071	3.12	419.57	28.00	0.14
Bypass to Coyote	139.366*	2950.00	55.95	72.73		73.34	0.000254	6.27	473.96	32.00	0.27
Bypass to Coyote	139.366*	4150.00	55.95	74.54		75.51	0.000355	7.93	532.04	32.00	0.32
Bypass to Coyote	139.366*	5360.00	55.95	76.36		77.69	0.000431	9.30	590.19	32.00	0.36
Bypass to Coyote	137.7	690.00	55.95	68.99		69.04	0.000029	1.89	365.02	28.00	0.09
Bypass to Coyote	137.7	1310.00	55.95	70.93		71.08	0.000068	3.12	423.27	32.00	0.14
Bypass to Coyote	137.7	2950.00	55.95	72.72		73.32	0.000234	6.24	480.50	32.00	0.27
Bypass to Coyote	137.7	4150.00	55.95	74.54		75.50	0.000326	7.89	538.81	32.00	0.32
Bypass to Coyote	137.7	5360.00	55.95	76.36		77.68	0.000396	9.26	596.96	32.00	0.36
Bypass to Coyote	136.033*	690.00	55.95	68.99		69.04	0.000029	1.89	365.01	28.00	0.09
Bypass to Coyote	136.033*	1310.00	55.95	70.93		71.08	0.000068	3.12	423.23	32.00	0.14
Bypass to Coyote	136.033*	2950.00	55.95	72.72		73.32	0.000234	6.24	480.36	32.00	0.27
Bypass to Coyote	136.033*	4150.00	55.95	74.54		75.50	0.000326	7.90	538.60	32.00	0.32
Bypass to Coyote	136.033*	5360.00	55.95	76.35		77.67	0.000396	9.27	596.69	32.00	0.36
Bypass to Coyote	134.366*	690.00	55.95	68.99		69.04	0.000029	1.89	365.00	28.00	0.09
Bypass to Coyote	134.366*	1310.00	55.95	70.93		71.08	0.000068	3.12	423.19	32.00	0.14
Bypass to Coyote	134.366*	2950.00	55.95	72.71		73.32	0.000234	6.25	480.23	32.00	0.27
Bypass to Coyote	134.366*	4150.00	55.95	74.53		75.49	0.000326	7.90	538.40	32.00	0.32
Bypass to Coyote	134.366*	5360.00	55.95	76.34		77.66	0.000397	9.27	596.42	32.00	0.36

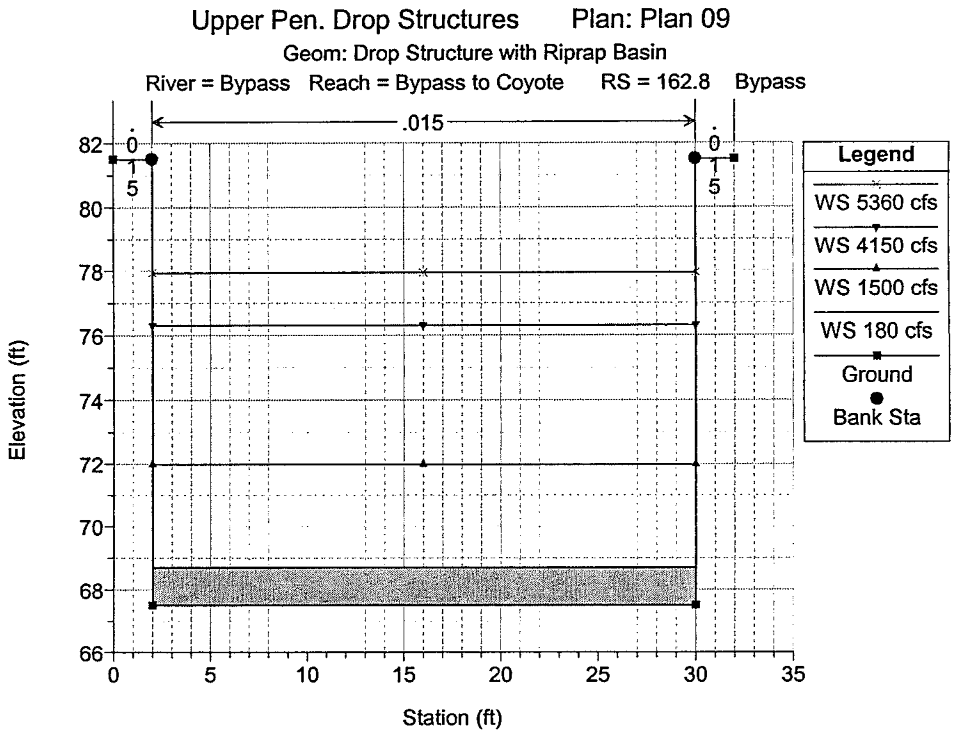
HEC-RAS Plan: Plan 05 River: Bypass Reach: Bypass to Coyote (Continued)

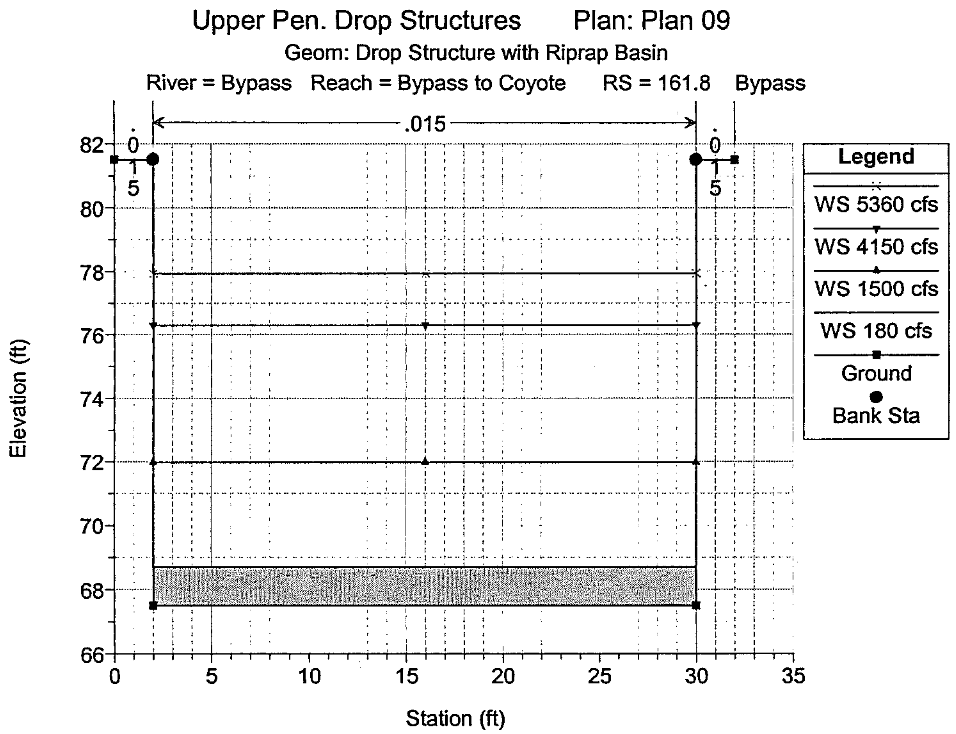
Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Bypass to Coyote	132.7	690.00	55.95	68.99		69.04	0.000029	1.89	364.98	28.00	0.09
Bypass to Coyote	132.7	1310.00	55.95	70.93		71.08	0.000068	3.12	423.15	32.00	0.14
Bypass to Coyote	132.7	2950.00	55.95	72.71		73.31	0.000234	6.25	480.09	32.00	0.27
Bypass to Coyote	132.7	4150.00	55.95	74.52		75.49	0.000327	7.90	538.19	32.00	0.32
Bypass to Coyote	132.7	5360.00	55.95	76.34		77.66	0.000398	9.27	596.16	32.00	0.36
Bypass to Coyote	131.033*	690.00	55.95	68.98		69.04	0.000029	1.89	364.97	28.00	0.09
Bypass to Coyote	131.033*	1310.00	55.95	70.93		71.08	0.000068	3.12	423.12	32.00	0.14
Bypass to Coyote	131.033*	2950.00	55.95	72.70		73.31	0.000235	6.25	479.95	32.00	0.27
Bypass to Coyote	131.033*	4150.00	55.95	74.52		75.48	0.000327	7.90	537.98	32.00	0.32
Bypass to Coyote	131.033*	5360.00	55.95	76.33		77.65	0.000398	9.28	595.89	32.00	0.36
Bypass to Coyote	129.366*	690.00	55.95	68.98		69.04	0.000029	1.89	364.96	28.00	0.09
Bypass to Coyote	129.366*	1310.00	55.95	70.93		71.08	0.000068	3.12	423.08	32.00	0.14
Bypass to Coyote	129.366*	2950.00	55.95	72.70		73.30	0.000235	6.25	479.81	32.00	0.27
Bypass to Coyote	129.366*	4150.00	55.95	74.51		75.47	0.000327	7.91	537.78	32.00	0.32
Bypass to Coyote	129.366*	5360.00	55.95	76.32		77.64	0.000399	9.28	595.63	32.00	0.36
Bypass to Coyote	127.7	690.00	55.95	68.98		69.04	0.000029	1.89	364.94	28.00	0.09
Bypass to Coyote	127.7	1310.00	55.95	70.93		71.08	0.000068	3.12	423.04	32.00	0.14
Bypass to Coyote	127.7	2950.00	55.95	72.70		73.30	0.000235	6.25	479.67	32.00	0.27
Bypass to Coyote	127.7	4150.00	55.95	74.51		75.47	0.000328	7.91	537.57	32.00	0.32
Bypass to Coyote	127.7	5360.00	55.95	76.31		77.63	0.000399	9.29	595.36	32.00	0.36
Bypass to Coyote	126.033*	690.00	55.95	68.98		69.04	0.000029	1.89	364.93	28.00	0.09
Bypass to Coyote	126.033*	1310.00	55.95	70.93		71.08	0.000068	3.12	423.01	32.00	0.14
Bypass to Coyote	126.033*	2950.00	55.95	72.69		73.30	0.000235	6.25	479.53	32.00	0.27
Bypass to Coyote	126.033*	4150.00	55.95	74.50		75.46	0.000328	7.91	537.37	32.00	0.32
Bypass to Coyote	126.033*	5360.00	55.95	76.30		77.63	0.000400	9.29	595.09	32.00	0.36
Bypass to Coyote	124.366*	690.00	55.95	68.98		69.04	0.000029	1.89	364.91	28.00	0.09
Bypass to Coyote	124.366*	1310.00	55.95	70.92		71.07	0.000068	3.12	422.97	32.00	0.14
Bypass to Coyote	124.366*	2950.00	55.95	72.69		73.29	0.000235	6.26	479.39	32.00	0.27
Bypass to Coyote	124.366*	4150.00	55.95	74.49		75.46	0.000329	7.92	537.16	32.00	0.32
Bypass to Coyote	124.366*	5360.00	55.95	76.29		77.62	0.000400	9.29	594.83	32.00	0.36
Bypass to Coyote	122.7	690.00	55.95	68.98		69.04	0.000029	1.89	364.90	28.00	0.09
Bypass to Coyote	122.7	1310.00	55.95	70.92		71.07	0.000068	3.12	422.93	32.00	0.14
Bypass to Coyote	122.7	2950.00	55.95	72.68		73.29	0.000236	6.26	479.26	32.00	0.27
Bypass to Coyote	122.7	4150.00	55.95	74.49		75.45	0.000329	7.92	536.96	32.00	0.32
Bypass to Coyote	122.7	5360.00	55.95	76.29		77.61	0.000401	9.30	594.56	32.00	0.36
Bypass to Coyote	121.033*	690.00	55.95	68.98		69.04	0.000029	1.89	364.89	28.00	0.09
Bypass to Coyote	121.033*	1310.00	55.95	70.92		71.07	0.000068	3.12	422.89	32.00	0.14
Bypass to Coyote	121.033*	2950.00	55.95	72.68		73.28	0.000236	6.26	479.12	32.00	0.27
Bypass to Coyote	121.033*	4150.00	55.95	74.48		75.45	0.000329	7.92	536.75	32.00	0.32
Bypass to Coyote	121.033*	5360.00	55.95	76.28		77.61	0.000401	9.30	594.29	32.00	0.36
Bypass to Coyote	119.366*	690.00	55.95	68.98		69.04	0.000029	1.89	364.87	28.00	0.09
Bypass to Coyote	119.366*	1310.00	55.95	70.92		71.07	0.000068	3.12	422.86	32.00	0.14
Bypass to Coyote	119.366*	2950.00	55.95	72.67		73.28	0.000236	6.26	478.98	32.00	0.27
Bypass to Coyote	119.366*	4150.00	55.95	74.47		75.44	0.000330	7.92	536.55	32.00	0.32
Bypass to Coyote	119.366*	5360.00	55.95	76.27		77.60	0.000402	9.31	594.03	32.00	0.36
Bypass to Coyote	117.7	690.00	55.95	68.98		69.04	0.000029	1.89	364.86	28.00	0.09
Bypass to Coyote	117.7	1310.00	55.95	70.92		71.07	0.000068	3.12	422.82	32.00	0.14
Bypass to Coyote	117.7	2950.00	55.95	72.67		73.28	0.000236	6.26	478.84	32.00	0.27
Bypass to Coyote	117.7	4150.00	55.95	74.47		75.43	0.000330	7.93	536.34	32.00	0.32
Bypass to Coyote	117.7	5360.00	55.95	76.26		77.59	0.000403	9.31	593.76	32.00	0.36
Bypass to Coyote	116.033*	690.00	55.95	68.98		69.04	0.000029	1.89	364.85	28.00	0.09
Bypass to Coyote	116.033*	1310.00	55.95	70.92		71.07	0.000068	3.12	422.78	32.00	0.14
Bypass to Coyote	116.033*	2950.00	55.95	72.67		73.27	0.000236	6.26	478.70	32.00	0.27
Bypass to Coyote	116.033*	4150.00	55.95	74.46		75.43	0.000331	7.93	536.13	32.00	0.32
Bypass to Coyote	116.033*	5360.00	55.95	76.25		77.58	0.000403	9.31	593.49	32.00	0.36
Bypass to Coyote	114.366*	690.00	55.95	68.98		69.04	0.000029	1.89	364.83	28.00	0.09
Bypass to Coyote	114.366*	1310.00	55.95	70.92		71.07	0.000068	3.12	422.74	32.00	0.14
Bypass to Coyote	114.366*	2950.00	55.95	72.66		73.27	0.000237	6.27	478.56	32.00	0.27
Bypass to Coyote	114.366*	4150.00	55.95	74.45		75.42	0.000331	7.93	535.93	32.00	0.32
Bypass to Coyote	114.366*	5360.00	55.95	76.24		77.58	0.000404	9.32	593.23	32.00	0.36

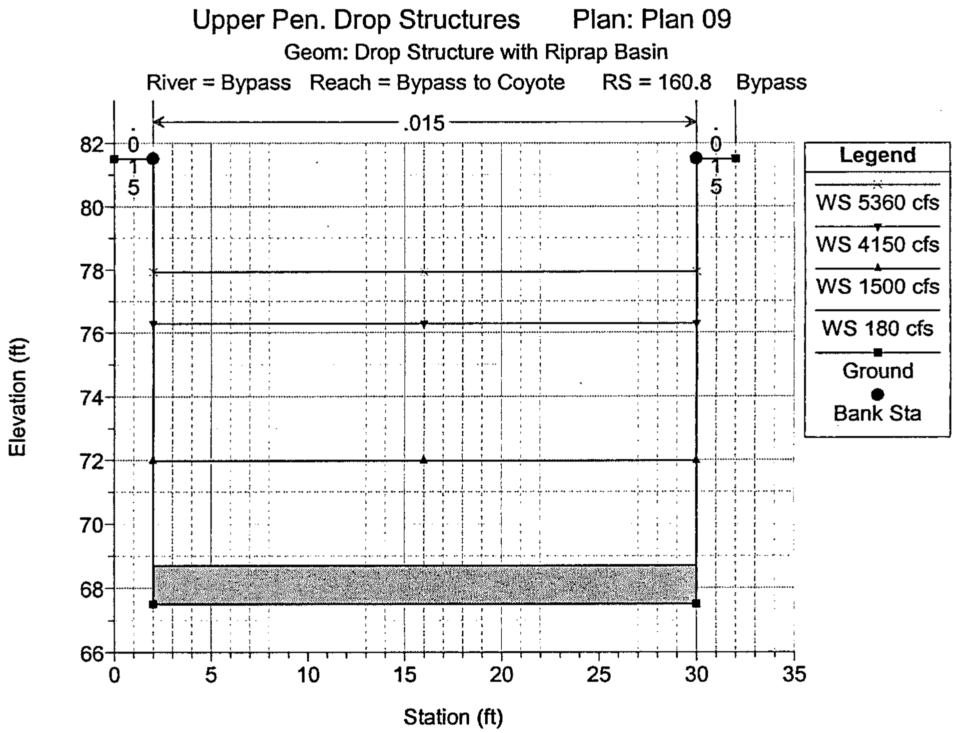
HEC-RAS Plan: Plan 05 River: Bypass Reach: Bypass to Coyote (Continued)

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Bypass to Coyote	112.7	690.00	55.95	68.98		69.03	0.000029	1.89	364.82	28.00	0.09
Bypass to Coyote	112.7	1310.00	55.95	70.92		71.07	0.000068	3.12	422.71	32.00	0.14
Bypass to Coyote	112.7	2950.00	55.95	72.66		73.26	0.000237	6.27	478.42	32.00	0.27
Bypass to Coyote	112.7	4150.00	55.95	74.45		75.42	0.000331	7.94	535.72	32.00	0.33
Bypass to Coyote	112.7	5360.00	55.95	76.24		77.57	0.000404	9.32	592.96	32.00	0.36
Bypass to Coyote	111.35*	690.00	55.95	68.98		69.03	0.000029	1.89	364.81	28.00	0.09
Bypass to Coyote	111.35*	1310.00	55.95	70.91		71.07	0.000068	3.12	422.67	32.00	0.14
Bypass to Coyote	111.35*	2950.00	55.95	72.65		73.26	0.000237	6.27	478.28	32.00	0.27
Bypass to Coyote	111.35*	4150.00	55.95	74.44		75.41	0.000332	7.94	535.52	32.00	0.33
Bypass to Coyote	111.35*	5360.00	55.95	76.23		77.56	0.000405	9.32	592.70	32.00	0.36
Bypass to Coyote	110	690.00	55.95	68.98		69.03	0.000029	1.89	364.79	28.00	0.09
Bypass to Coyote	110	1310.00	55.95	70.91		71.06	0.000068	3.12	422.63	32.00	0.14
Bypass to Coyote	110	2950.00	55.95	72.65		73.26	0.000237	6.27	478.15	32.00	0.27
Bypass to Coyote	110	4150.00	55.95	74.43		75.41	0.000332	7.94	535.31	32.00	0.33
Bypass to Coyote	110	5360.00	55.95	76.22		77.56	0.000405	9.33	592.43	32.00	0.37
Bypass to Coyote	108	690.00	56.00	68.98		69.03	0.000029	1.90	363.38	28.00	0.09
Bypass to Coyote	108	1310.00	56.00	70.91		71.06	0.000069	3.13	421.19	32.00	0.14
Bypass to Coyote	108	2950.00	56.00	72.64		73.26	0.000239	6.29	476.61	32.00	0.27
Bypass to Coyote	108	4150.00	56.00	74.43		75.40	0.000335	7.97	533.71	32.00	0.33
Bypass to Coyote	108	5360.00	56.00	76.21		77.56	0.000408	9.36	590.76	32.00	0.37
Bypass to Coyote	106	690.00	56.00	68.98		69.03	0.000029	1.90	363.38	28.00	0.09
Bypass to Coyote	106	1310.00	56.00	70.91		71.06	0.000069	3.13	421.19	32.00	0.14
Bypass to Coyote	106	2950.00	56.00	72.64		73.25	0.000239	6.29	476.58	32.00	0.27
Bypass to Coyote	106	4150.00	56.00	74.43		75.40	0.000335	7.97	533.65	32.00	0.33
Bypass to Coyote	106	5360.00	56.00	76.21		77.55	0.000408	9.36	590.66	32.00	0.37
Bypass to Coyote	104	690.00	56.00	68.98		69.03	0.000029	1.90	363.38	28.00	0.09
Bypass to Coyote	104	1310.00	56.00	70.91		71.06	0.000069	3.13	421.19	32.00	0.14
Bypass to Coyote	104	2950.00	56.00	72.64		73.25	0.000239	6.29	476.56	32.00	0.27
Bypass to Coyote	104	4150.00	56.00	74.43		75.40	0.000335	7.97	533.60	32.00	0.33
Bypass to Coyote	104	5360.00	56.00	76.21		77.55	0.000409	9.36	590.56	32.00	0.37
Bypass to Coyote	102	690.00	56.00	68.98		69.03	0.000029	1.90	363.37	28.00	0.09
Bypass to Coyote	102	1310.00	56.00	70.91		71.06	0.000069	3.13	421.18	32.00	0.14
Bypass to Coyote	102	2950.00	56.00	72.64		73.25	0.000239	6.29	476.53	32.00	0.27
Bypass to Coyote	102	4150.00	56.00	74.42		75.40	0.000335	7.97	533.55	32.00	0.33
Bypass to Coyote	102	5360.00	56.00	76.20		77.55	0.000409	9.36	590.47	32.00	0.37
Bypass to Coyote	100	690.00	56.00	68.98		69.03	0.000029	1.90	363.37	28.00	0.09
Bypass to Coyote	100	1310.00	56.00	70.91		71.06	0.000069	3.13	421.18	32.00	0.14
Bypass to Coyote	100	2950.00	56.00	72.64		73.25	0.000239	6.29	476.51	32.00	0.27
Bypass to Coyote	100	4150.00	56.00	74.42		75.40	0.000335	7.97	533.49	32.00	0.33
Bypass to Coyote	100	5360.00	56.00	76.20		77.54	0.000409	9.36	590.37	32.00	0.37
Bypass to Coyote	50	690.00	55.93	69.00	57.27	69.01	0.000063	0.68	1019.85	78.00	0.03
Bypass to Coyote	50	1310.00	55.93	71.00	57.98	71.02	0.000145	1.11	1180.15	82.00	0.05
Bypass to Coyote	50	2950.00	55.93	73.00	59.46	73.07	0.000477	2.19	1344.15	82.00	0.09
Bypass to Coyote	50	4150.00	55.93	75.00	60.37	75.12	0.000645	2.75	1508.15	82.00	0.11
Bypass to Coyote	50	5360.00	55.93	77.00	61.20	77.16	0.000766	3.20	1672.15	82.00	0.12

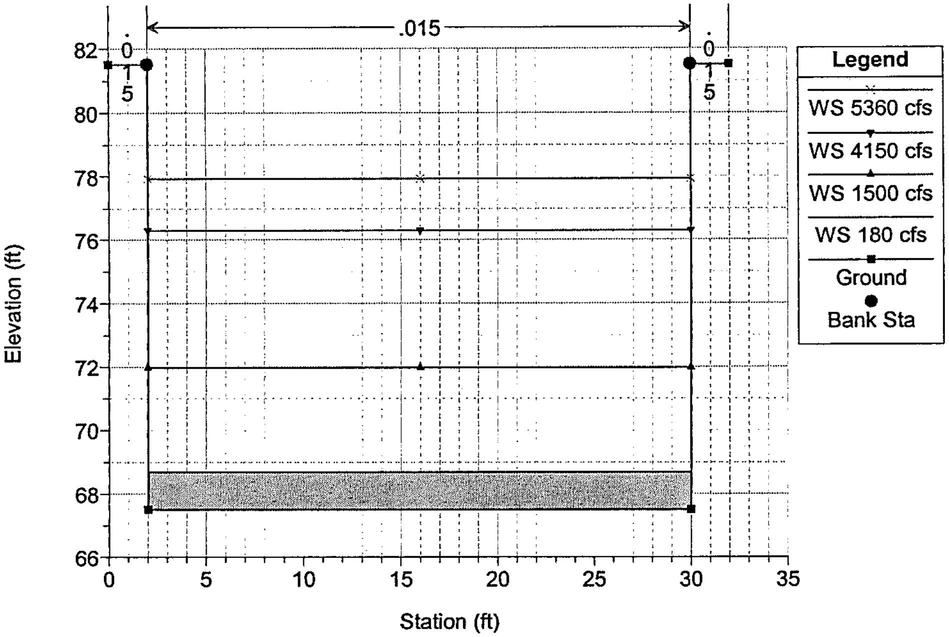

Upper Pen. Drop Structures Plan: Plan 09
Geom: Drop Structure with Riprap Basin
River = Bypass Reach = Bypass to Coyote RS = 167.7 Bypass


Upper Pen. Drop Structures Plan: Plan 09
Geom: Drop Structure with Riprap Basin
River = Bypass Reach = Bypass to Coyote RS = 162.8 Bypass

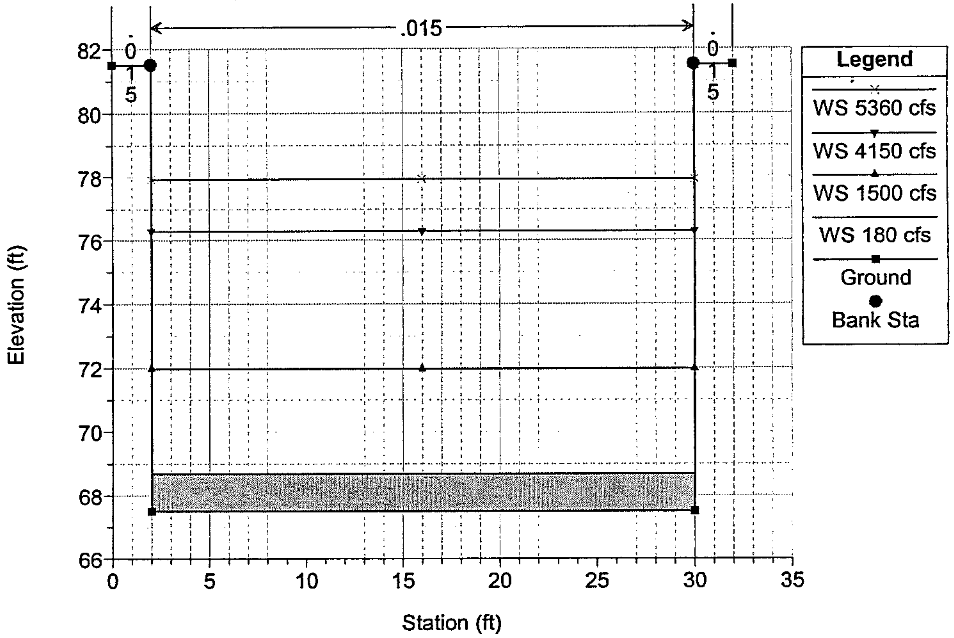

Upper Pen. Drop Structures Plan: Plan 09
Geom: Drop Structure with Riprap Basin
River = Bypass Reach = Bypass to Coyote RS = 161.8 Bypass


Upper Pen. Drop Structures Plan: Plan 09
Geom: Drop Structure with Riprap Basin
River = Bypass Reach = Bypass to Coyote RS = 160.8 Bypass

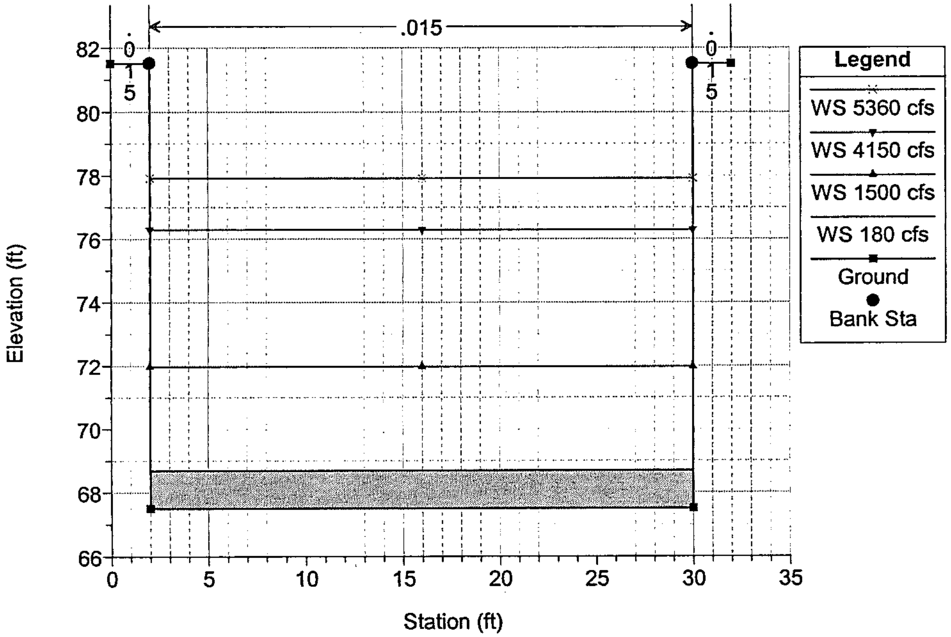
Upper Pen. Drop Structures Plan: Plan 09
Geom: Drop Structure with Riprap Basin
River = Bypass Reach = Bypass to Coyote RS = 159.8 Bypass



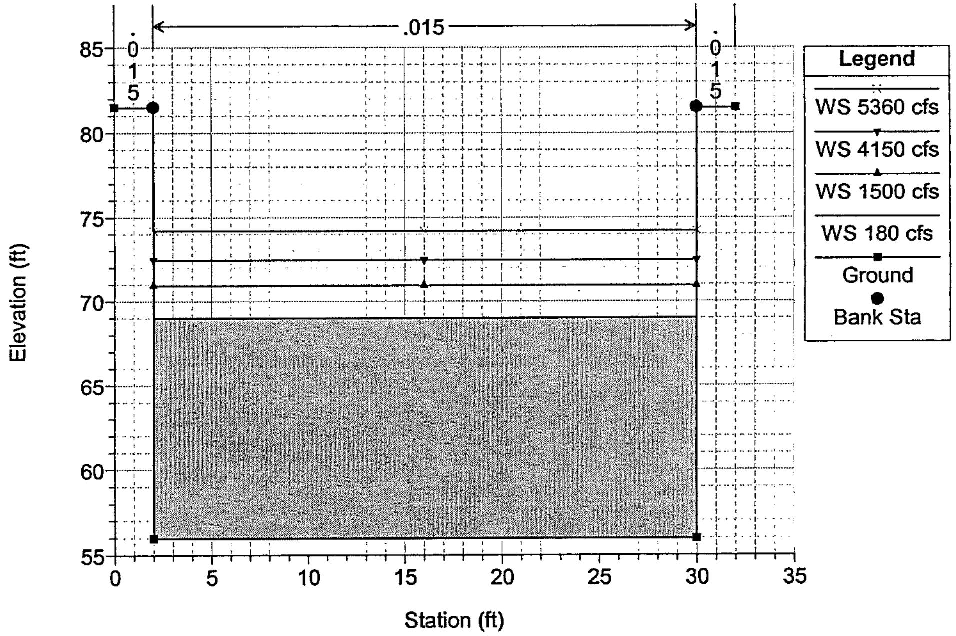
Upper Pen. Drop Structures Plan: Plan 09
Geom: Drop Structure with Riprap Basin
River = Bypass Reach = Bypass to Coyote RS = 158.8 Bypass

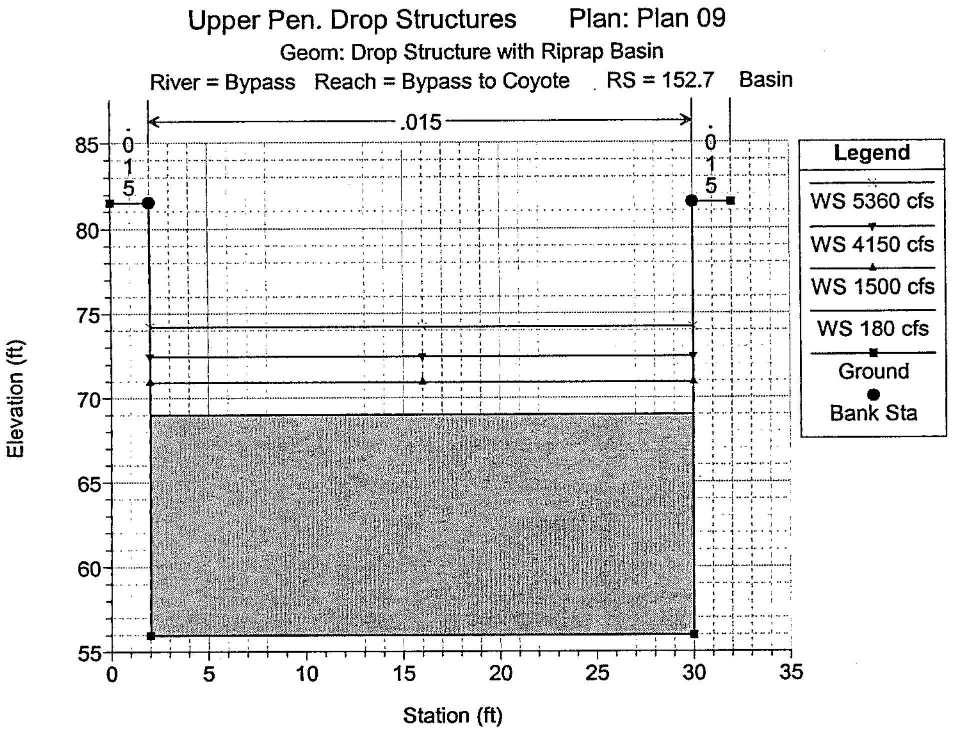


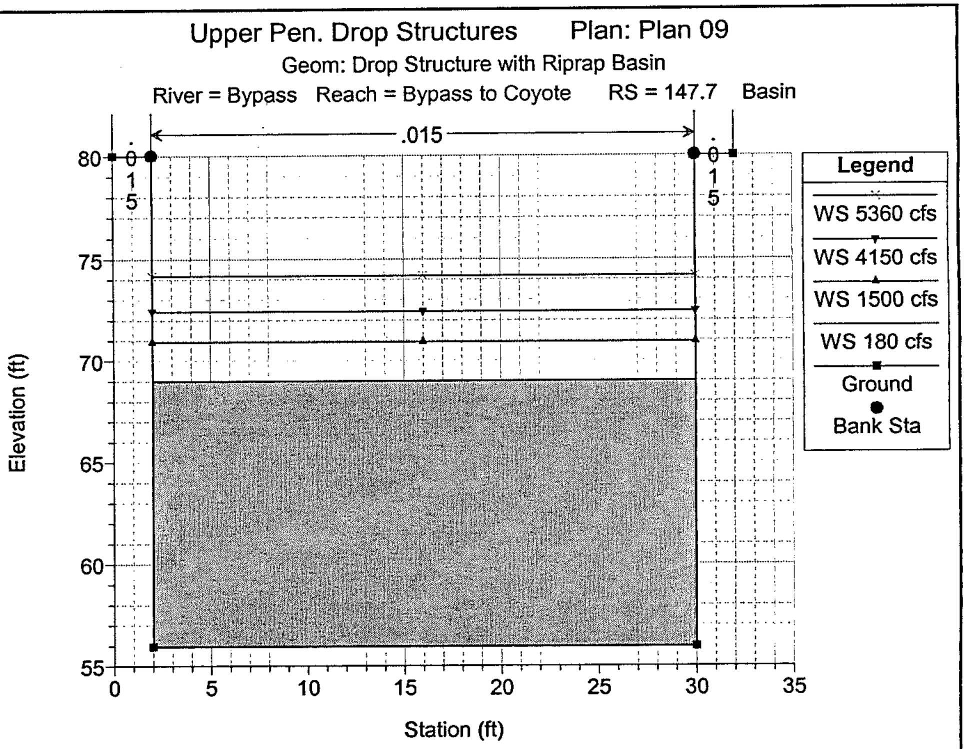
Upper Pen. Drop Structures Plan: Plan 09
Geom: Drop Structure with Riprap Basin
River = Bypass Reach = Bypass to Coyote RS = 157.8 Sill

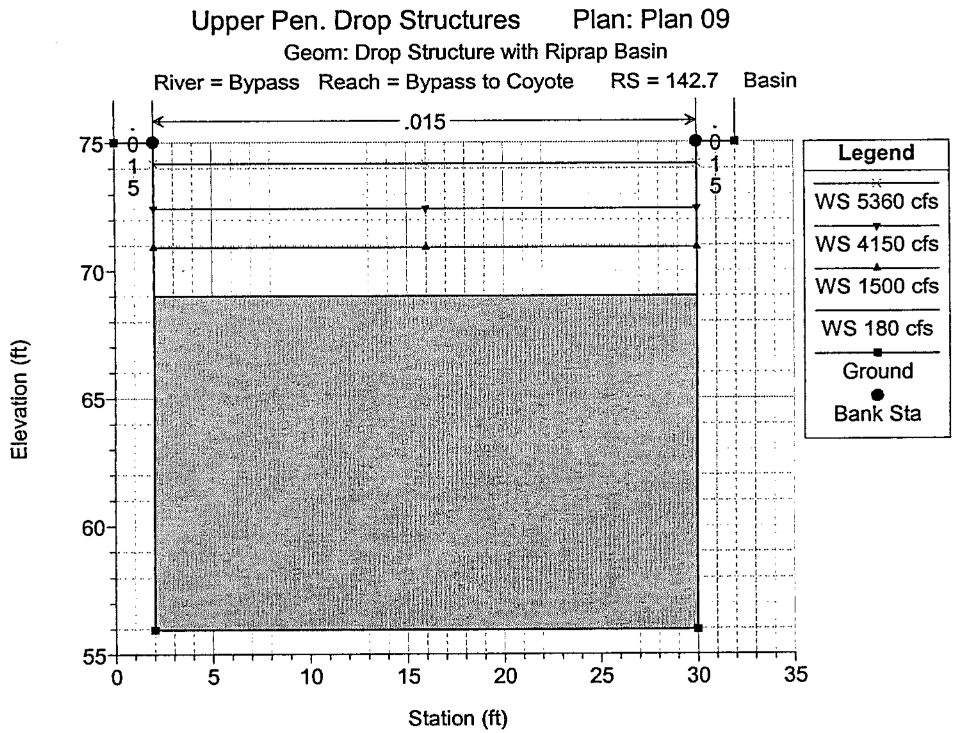


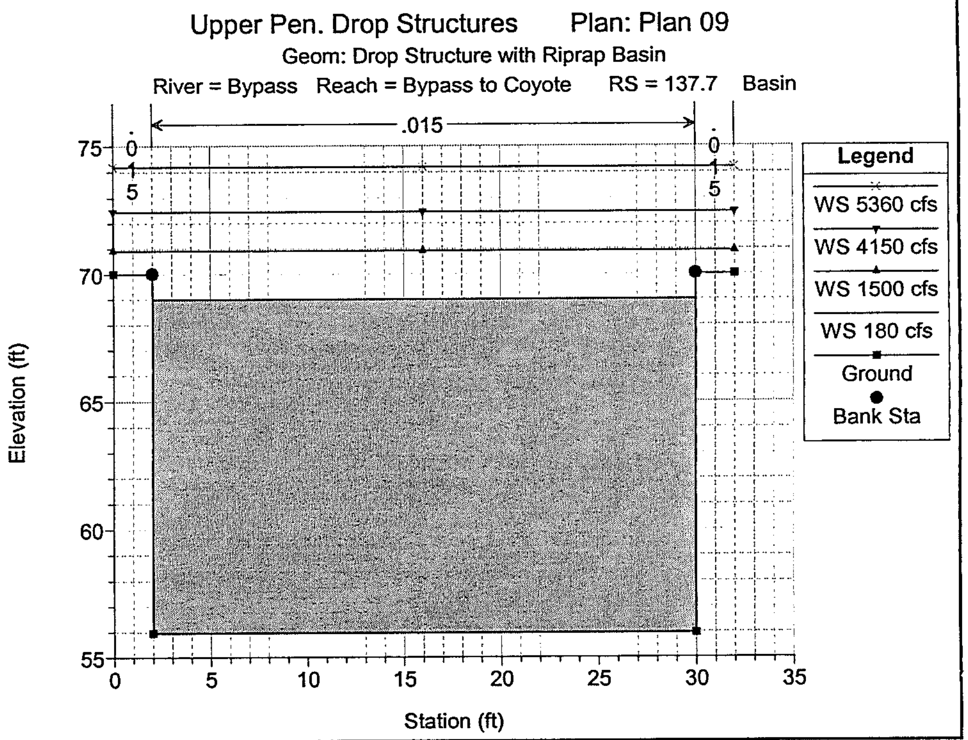
Upper Pen. Drop Structures Plan: Plan 09
Geom: Drop Structure with Riprap Basin
River = Bypass Reach = Bypass to Coyote RS = 157.7 Basin

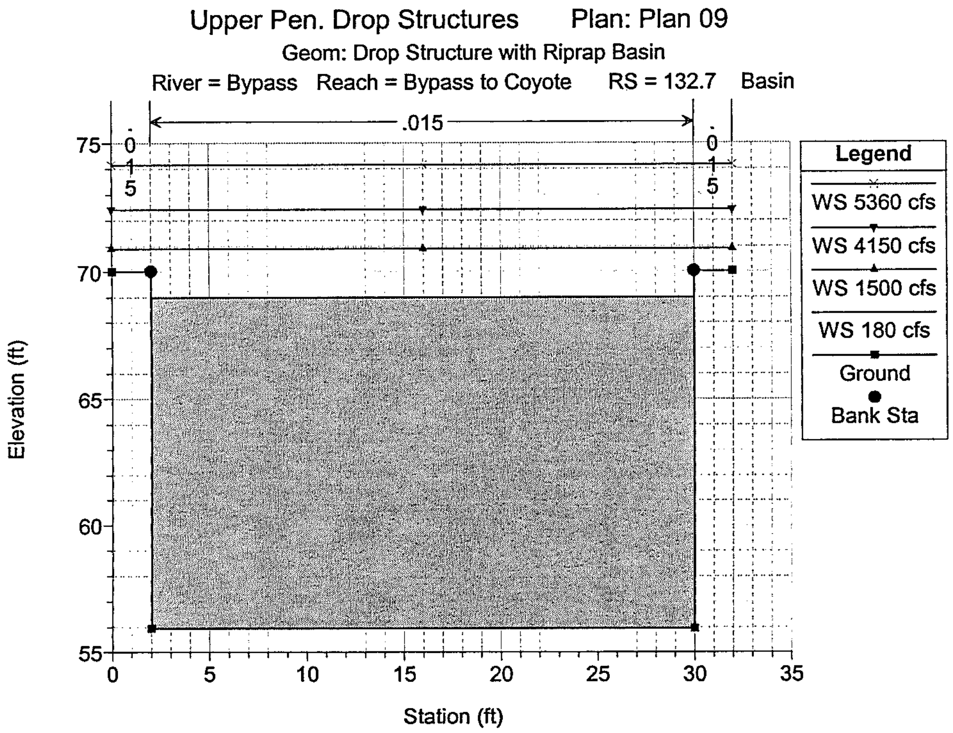


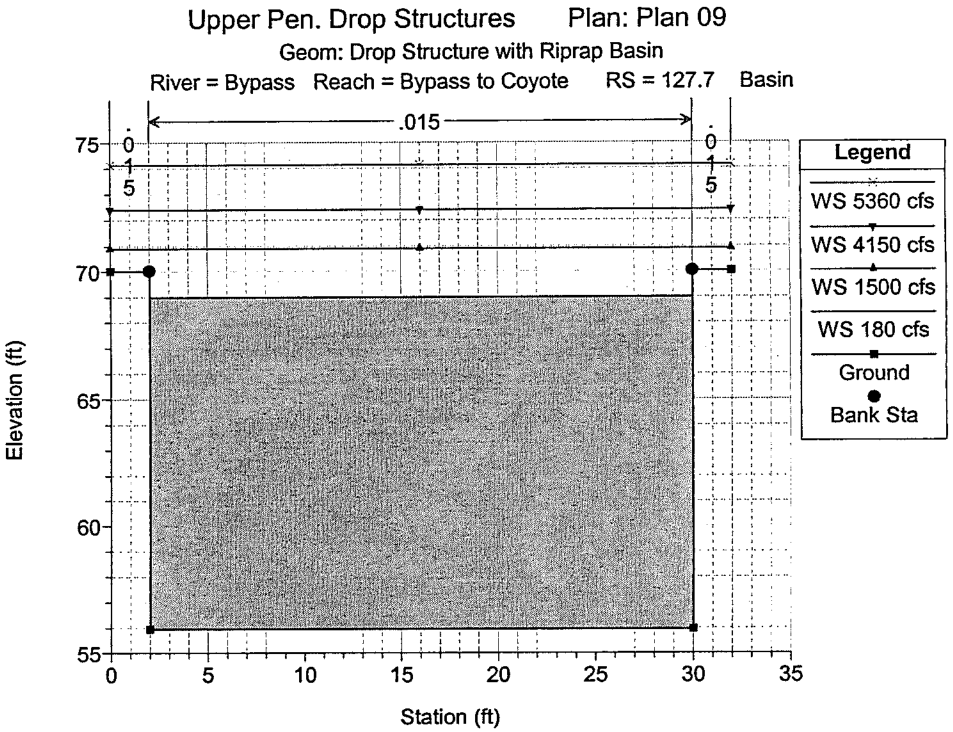

Upper Pen. Drop Structures Plan: Plan 09
Geom: Drop Structure with Riprap Basin
River = Bypass Reach = Bypass to Coyote RS = 152.7 Basin
.015
0
1
5
Elevation (ft)
Station (ft)
85
80
75
70
65
60
55
0
5
10
15
20
25
30
35
Legend
WS 5360 cfs
WS 4150 cfs
WS 1500 cfs
WS 180 cfs
Ground
Bank Sta

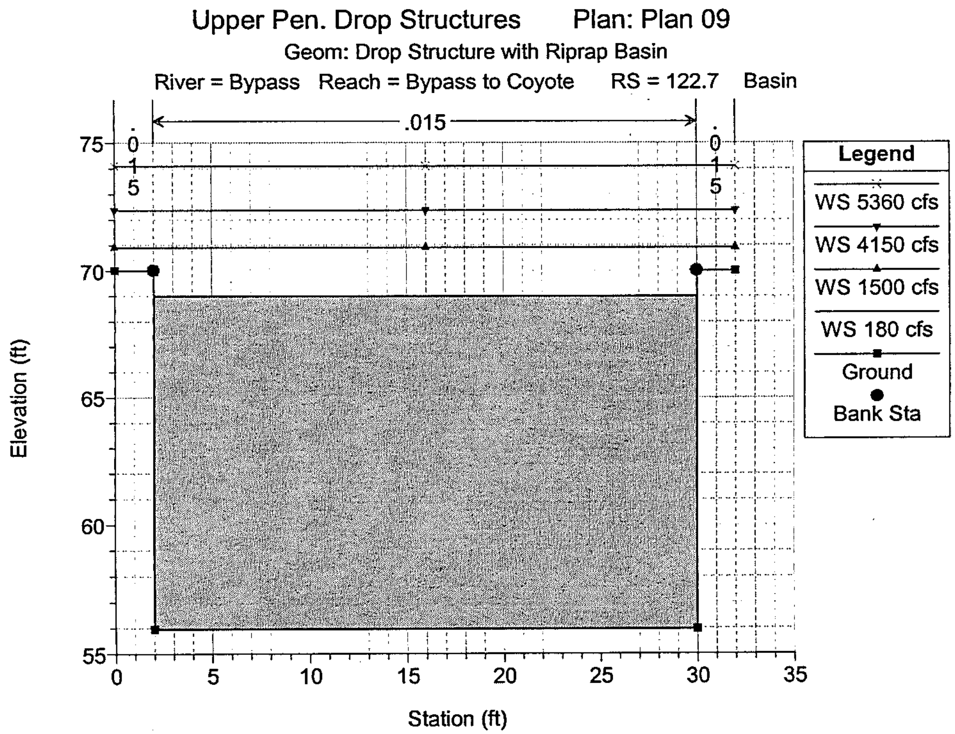

Upper Pen. Drop Structures Plan: Plan 09
Geom: Drop Structure with Riprap Basin
River = Bypass Reach = Bypass to Coyote RS = 147.7 Basin
.015
0
1
5
Elevation (ft)
Station (ft)
80
75
70
65
60
55
0
5
10
15
20
25
30
35
Legend
WS 5360 cfs
WS 4150 cfs
WS 1500 cfs
WS 180 cfs
Ground
Bank Sta

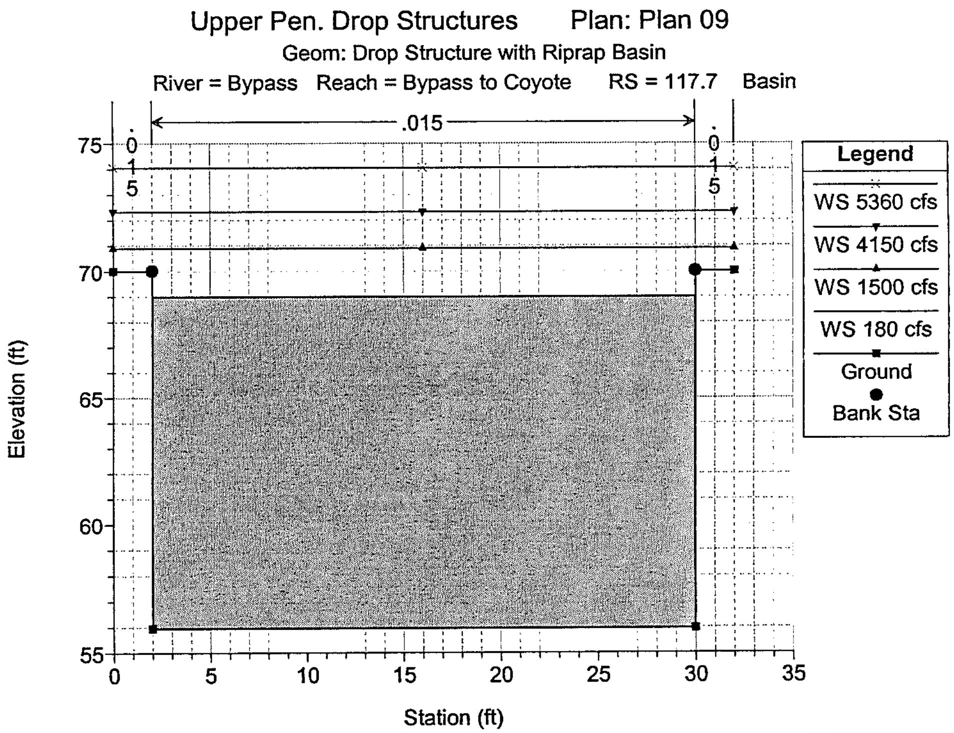

Upper Pen. Drop Structures Plan: Plan 09
Geom: Drop Structure with Riprap Basin
River = Bypass Reach = Bypass to Coyote RS = 142.7 Basin
.015
0
1
5
Elevation (ft)
Station (ft)
75
70
65
60
55
0
5
10
15
20
25
30
35
Legend
WS 5360 cfs
WS 4150 cfs
WS 1500 cfs
WS 180 cfs
Ground
Bank Sta

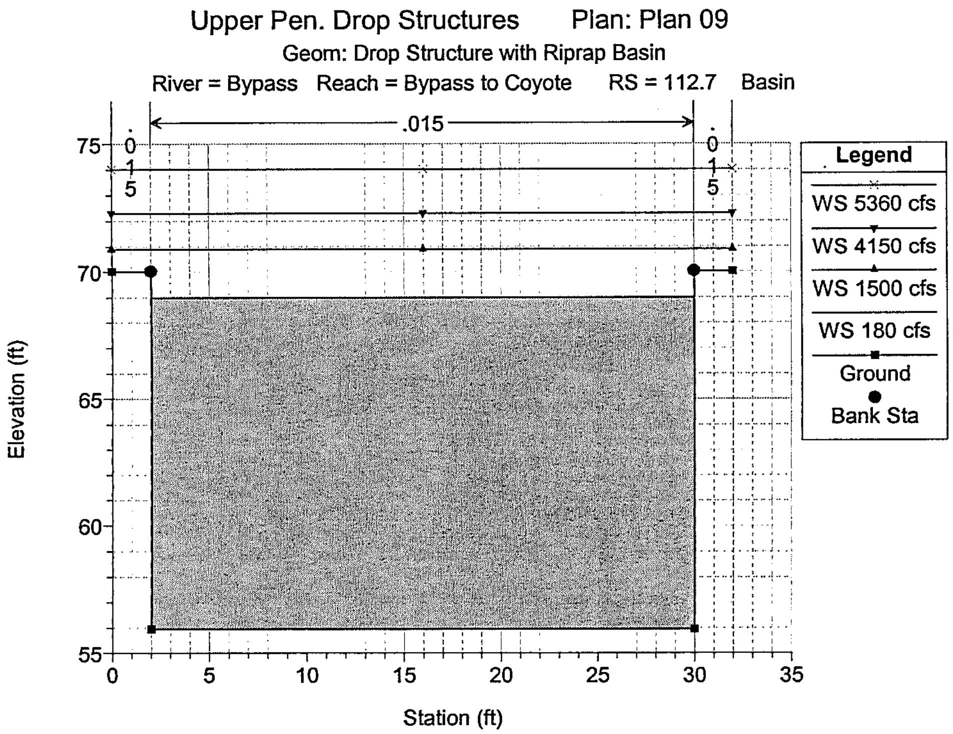

Upper Pen. Drop Structures Plan: Plan 09
Geom: Drop Structure with Riprap Basin
River = Bypass Reach = Bypass to Coyote RS = 137.7 Basin
.015
0
1
5
Elevation (ft)
Station (ft)
75
70
65
60
55
0
5
10
15
20
25
30
35
Legend
WS 5360 cfs
WS 4150 cfs
WS 1500 cfs
WS 180 cfs
Ground
Bank Sta

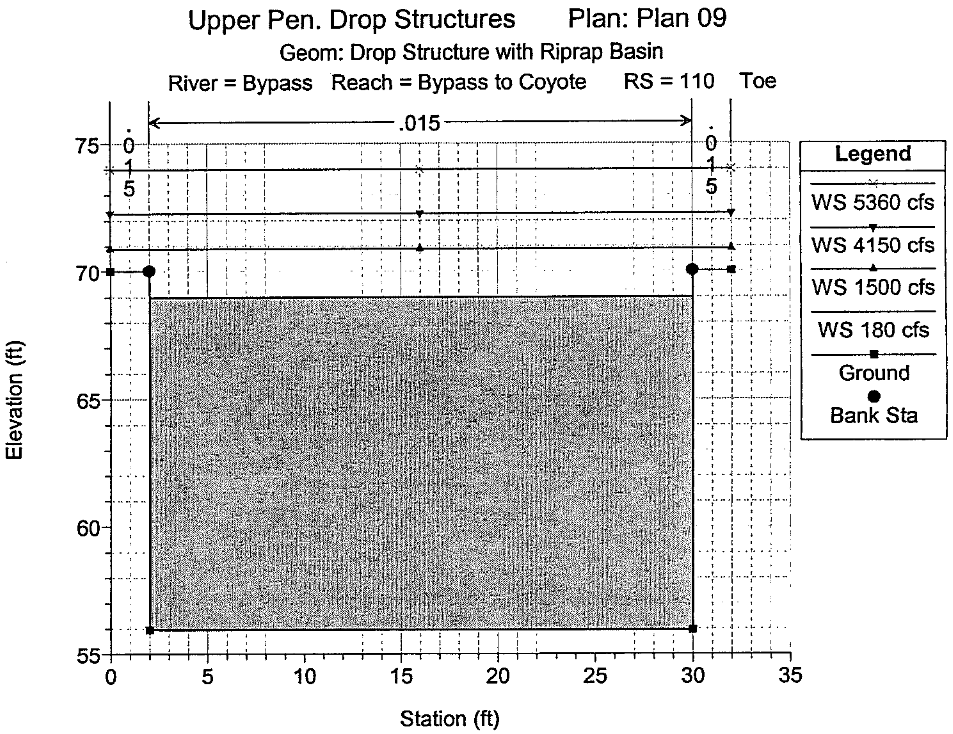

Upper Pen. Drop Structures Plan: Plan 09
Geom: Drop Structure with Riprap Basin
River = Bypass Reach = Bypass to Coyote RS = 132.7 Basin
.015
0
1
5
Legend
WS 5360 cfs
WS 4150 cfs
WS 1500 cfs
WS 180 cfs
Ground
Bank Sta
Elevation (ft)
75
70
65
60
55
Station (ft)
0
5
10
15
20
25
30
35

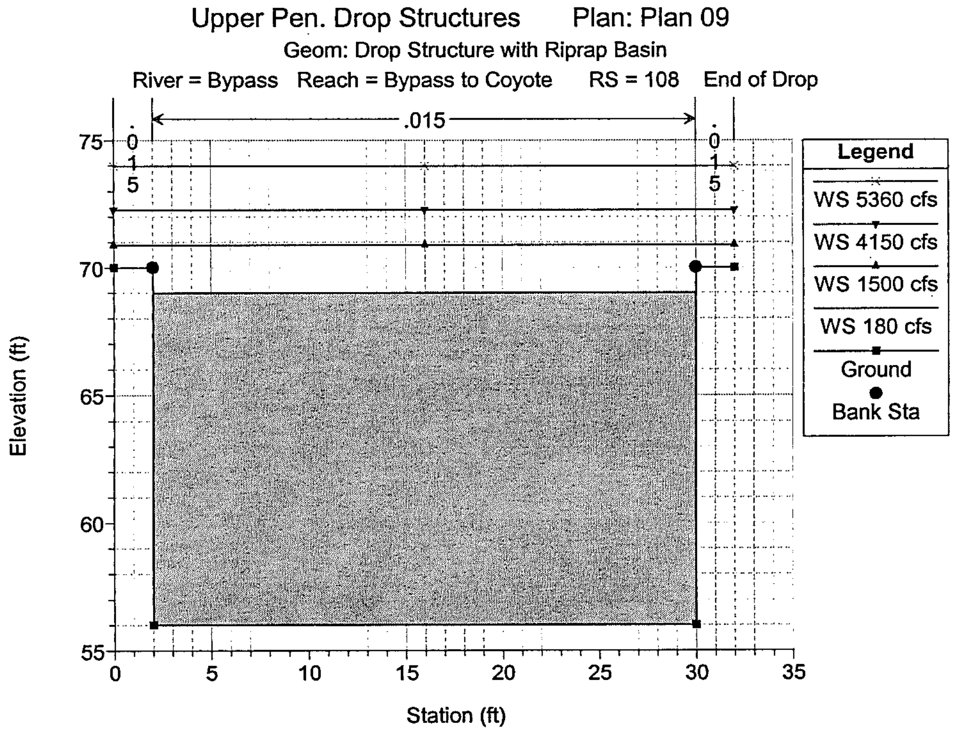

Upper Pen. Drop Structures Plan: Plan 09
Geom: Drop Structure with Riprap Basin
River = Bypass Reach = Bypass to Coyote RS = 127.7 Basin
.015
0
1
5
Legend
WS 5360 cfs
WS 4150 cfs
WS 1500 cfs
WS 180 cfs
Ground
Bank Sta
Elevation (ft)
75
70
65
60
55
Station (ft)
0
5
10
15
20
25
30
35

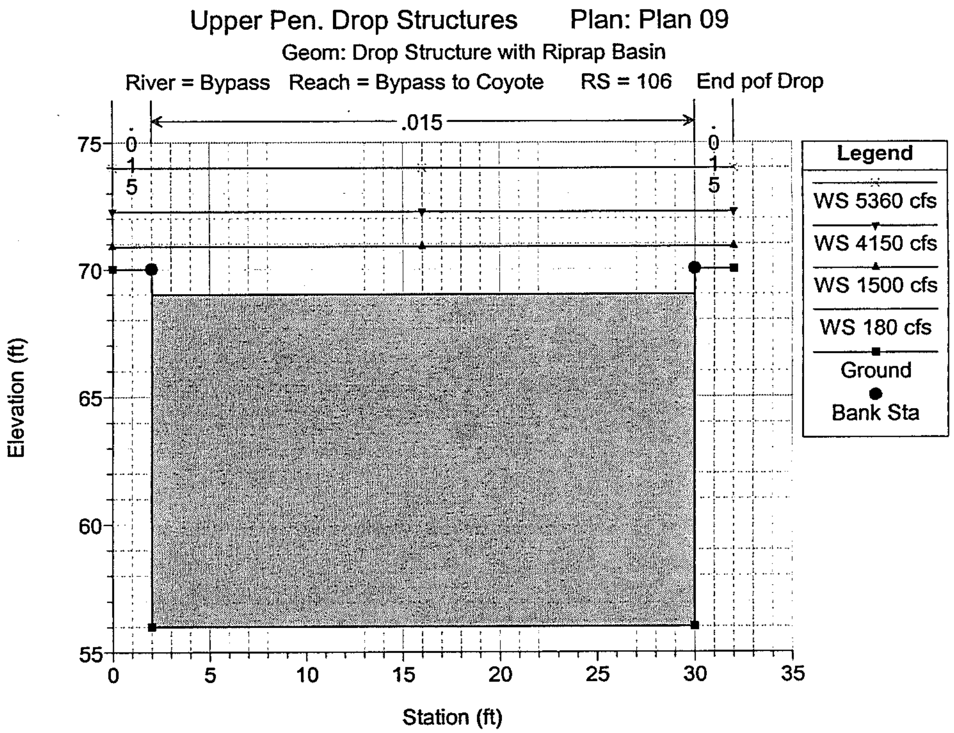

Upper Pen. Drop Structures Plan: Plan 09
Geom: Drop Structure with Riprap Basin
River = Bypass Reach = Bypass to Coyote RS = 122.7 Basin
.015
0
1
5
Legend
WS 5360 cfs
WS 4150 cfs
WS 1500 cfs
WS 180 cfs
Ground
Bank Sta
Elevation (ft)
75
70
65
60
55
Station (ft)
0
5
10
15
20
25
30
35

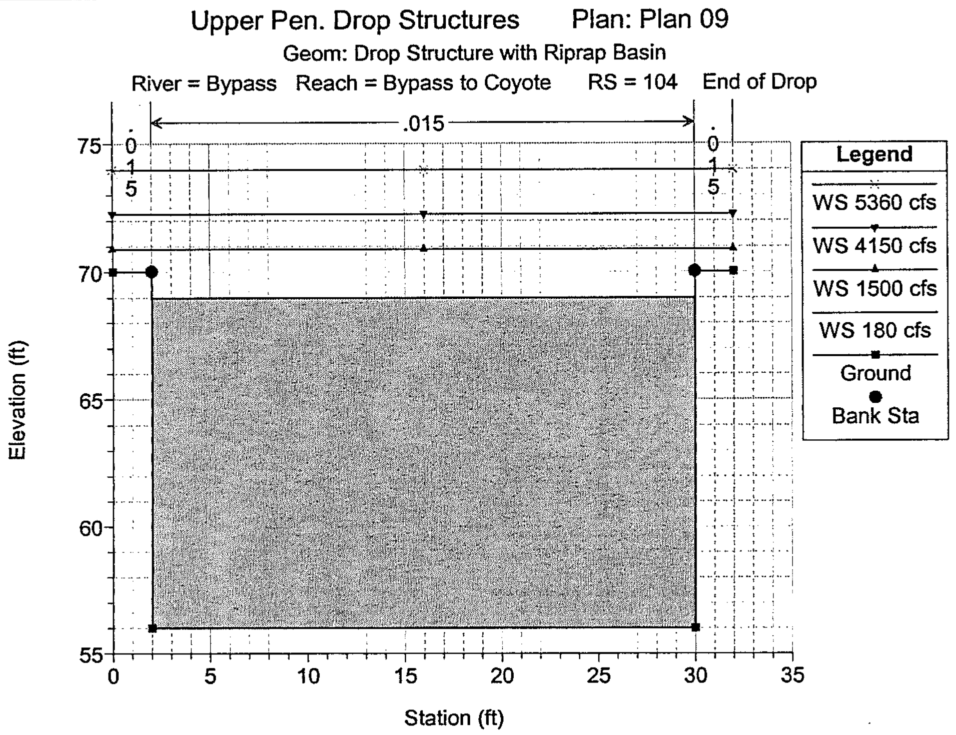

Upper Pen. Drop Structures Plan: Plan 09
Geom: Drop Structure with Riprap Basin
River = Bypass Reach = Bypass to Coyote RS = 117.7 Basin
.015
0
1
5
Legend
WS 5360 cfs
WS 4150 cfs
WS 1500 cfs
WS 180 cfs
Ground
Bank Sta
Elevation (ft)
75
70
65
60
55
Station (ft)
0
5
10
15
20
25
30
35

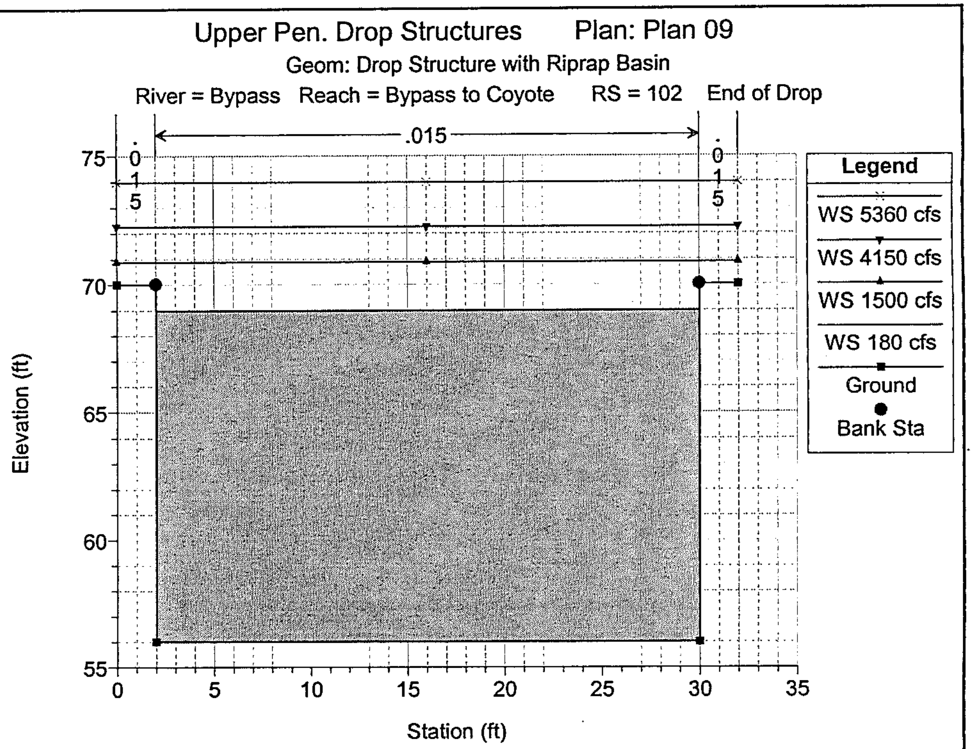

Upper Pen. Drop Structures Plan: Plan 09
Geom: Drop Structure with Riprap Basin
River = Bypass Reach = Bypass to Coyote RS = 112.7 Basin
.015
0
1
5
0
1
5
Legend
WS 5360 cfs
WS 4150 cfs
WS 1500 cfs
WS 180 cfs
Ground
Bank Sta
Elevation (ft)
75
70
65
60
55
Station (ft)
0
5
10
15
20
25
30
35

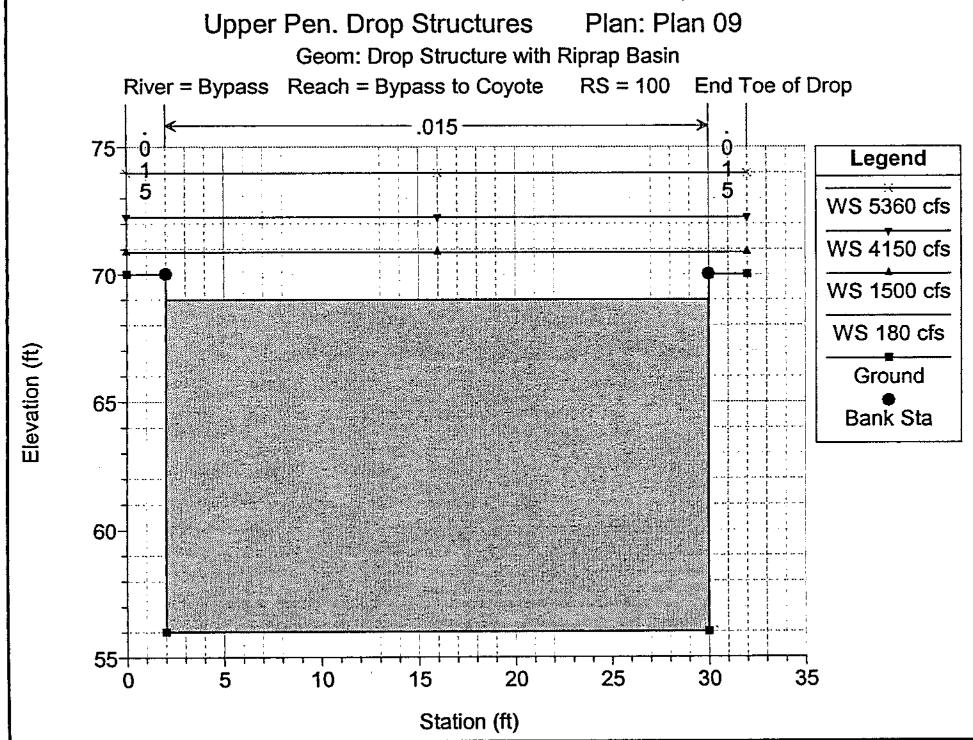

Upper Pen. Drop Structures Plan: Plan 09
Geom: Drop Structure with Riprap Basin
River = Bypass Reach = Bypass to Coyote RS = 110 Toe
.015
0
1
5
0
1
5
Legend
WS 5360 cfs
WS 4150 cfs
WS 1500 cfs
WS 180 cfs
Ground
Bank Sta
Elevation (ft)
75
70
65
60
55
Station (ft)
0
5
10
15
20
25
30
35

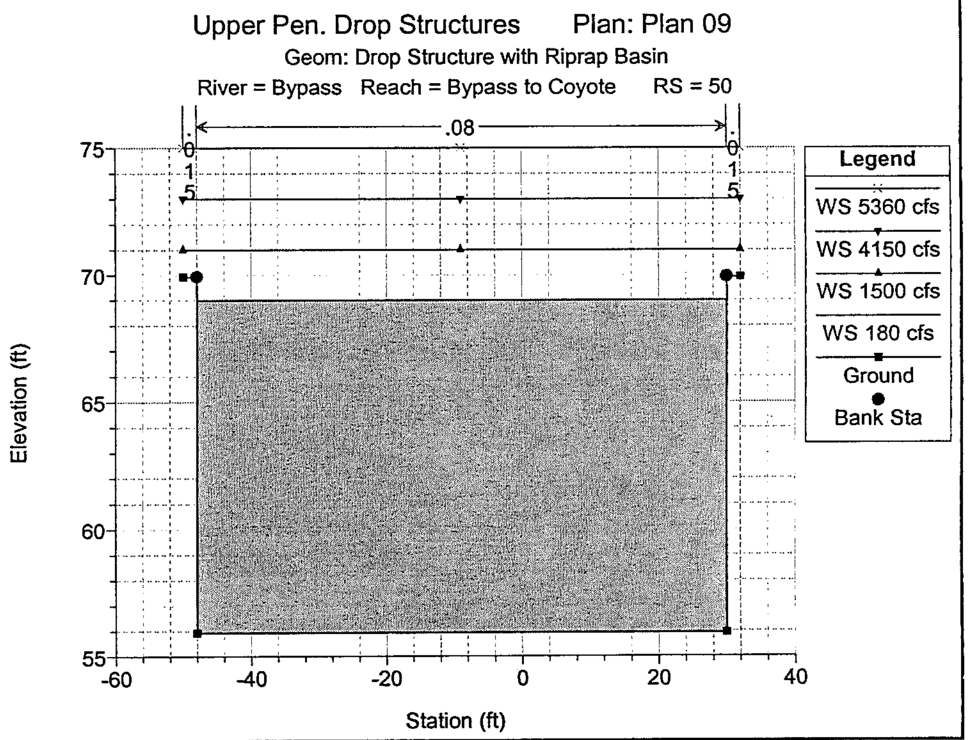

Upper Pen. Drop Structures Plan: Plan 09
Geom: Drop Structure with Riprap Basin
River = Bypass Reach = Bypass to Coyote RS = 108 End of Drop
.015
0
1
5
0
1
5
Legend
WS 5360 cfs
WS 4150 cfs
WS 1500 cfs
WS 180 cfs
Ground
Bank Sta
Elevation (ft)
75
70
65
60
55
Station (ft)
0
5
10
15
20
25
30
35


Upper Pen. Drop Structures Plan: Plan 09
Geom: Drop Structure with Riprap Basin
River = Bypass Reach = Bypass to Coyote RS = 106 End pof Drop
.015
0
1
5
0
1
5
Legend
WS 5360 cfs
WS 4150 cfs
WS 1500 cfs
WS 180 cfs
Ground
Bank Sta
Elevation (ft)
75
70
65
60
55
Station (ft)
0
5
10
15
20
25
30
35


Upper Pen. Drop Structures Plan: Plan 09
Geom: Drop Structure with Riprap Basin
River = Bypass Reach = Bypass to Coyote RS = 104 End of Drop
.015
.015
.015
Legend
WS 5360 cfs
WS 4150 cfs
WS 1500 cfs
WS 180 cfs
Ground
Bank Sta
Elevation (ft)
55
60
65
70
75
Station (ft)
0
5
10
15
20
25
30
35


Upper Pen. Drop Structures Plan: Plan 09
Geom: Drop Structure with Riprap Basin
River = Bypass Reach = Bypass to Coyote RS = 102 End of Drop
.015
.015
.015
Legend
WS 5360 cfs
WS 4150 cfs
WS 1500 cfs
WS 180 cfs
Ground
Bank Sta
Elevation (ft)
55
60
65
70
75
Station (ft)
0
5
10
15
20
25
30
35


Upper Pen. Drop Structures Plan: Plan 09
Geom: Drop Structure with Riprap Basin
River = Bypass Reach = Bypass to Coyote RS = 100 End Toe of Drop
.015
.015
.015
Legend
WS 5360 cfs
WS 4150 cfs
WS 1500 cfs
WS 180 cfs
Ground
Bank Sta
Elevation (ft)
55
60
65
70
75
Station (ft)
0
5
10
15
20
25
30
35


Upper Pen. Drop Structures Plan: Plan 09
Geom: Drop Structure with Riprap Basin
River = Bypass Reach = Bypass to Coyote RS = 50
.015
.08
.015
Legend
WS 5360 cfs
WS 4150 cfs
WS 1500 cfs
WS 180 cfs
Ground
Bank Sta
Elevation (ft)
55
60
65
70
75
Station (ft)
-60
-40
-20
0
20
40

Hand Calculations

Job No. 10841-001-141 No.

HDR Computation

HDR

Project UPPER PENITENCIA CREEK
Computed JB
Date 08-23-01
Subject
Checked
Date
Task SIDE WEIR COEFFICIENT
Sheet 1
Of 1

$$C = \frac{2}{3} C_d \sqrt{2g}$$

C_d .. REFERS TO DE MARCHI COEFFICIENT OF DISCHARGE C_m

THREE DIFFERENT FORMULAS WERE USED TO CALCULATE AN AVG C_m:

$$C_{m_1} = 0.864 \left(\frac{1 - F^2}{2 + F^2} \right)^{0.5}$$ (SUBRAMANYA & AWASATHY)

$$C_{m_2} = 0.81 - 0.6F$$ (RANGA & RAJU ET AL 1979)

$$C_{m_3} = 0.485 \left(\frac{2 + F_1^2}{2 + 3F_1^2} \right)$$ (HAGER 1987)

$F \rightarrow$ FROUDE # OF APPROACH VELOCITY WAS OBTAINED FROM HEC RAS USING THE 5, 10, 50, 100 & 500 YR FLOW EVENTS

CALCULATIONS FOR A TYPICAL CROSS SECTION WERE CARRIED OUT AS FOLLOWS:

CROSS SECTION	FLOW	FROUDE #	C_{m_1}	C_{m_2}	C_{m_3}	C_m (AVG)
4535	4740	0.17	0.60	0.71	0.47	0.59

$$C = \frac{2}{3} C_m(\text{AVG}) \sqrt{2g} = \frac{2}{3}(.59)\sqrt{2\,(32.2)}$$

$$C = 3.16$$

A SIDE WEIR COEFFICIENT WAS GENERATED FOR EACH OF SEVEN CROSS SECTIONS THAT TRAVERSE THE WEIR USING THE PREVIOUSLY INDICATED FLOW EVENTS & SEVERAL MANNING COEFFICIENTS.

THE AVERAGE VALUE FOR THE SIDE WEIR COEFFICIENT = 3.05

Job No.

No.

HDR Computation

Project UPPER PENITENCIA CREEK

Computed CST

Date 6-8-01

Subject SINGLE BOX TYPICAL XS

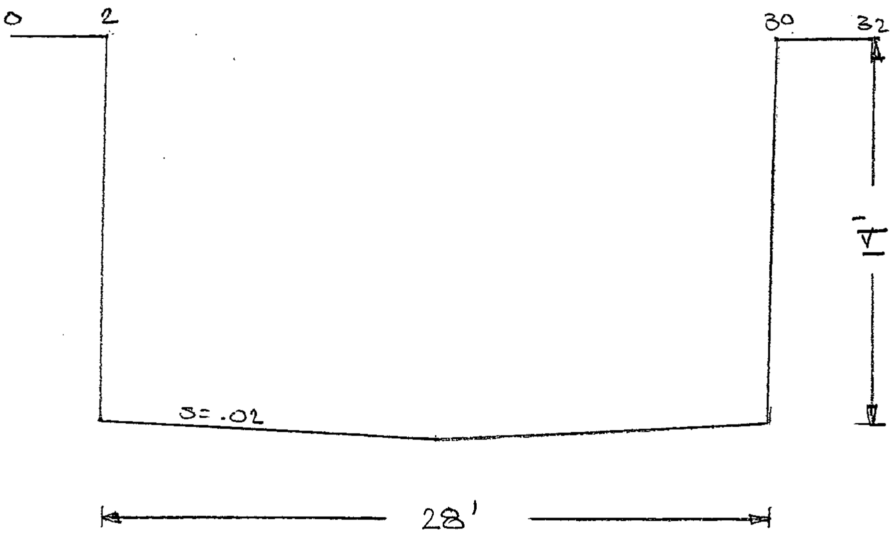
Checked

Date

Task CHARACTERISTIC HYDRAULIC VALUES

Sheet 1

Of 2



$n = 0.015$

$S = 0.0015$

$Q = 4140$ CFS

$$q = \frac{4140 \text{ CFS}}{28 \text{ FT}} = 147.9 \text{ CFS/FT}$$

$$y_c = \sqrt[3]{\frac{q^2}{g}} = \sqrt[3]{\frac{(147.9)^2}{32.2}} = 8.79 \text{ FT}$$ (CRITICAL DEPTH)

$$E_{MIN} = \frac{3}{2} y_c = 13.19 \text{ FT}$$

$$Q = \frac{1.49}{n} A R^{2/3} S^{1/2}$$

$$4140 \text{ CFS} = \frac{1.49}{0.015} (28d) \left(\frac{28d}{2d+28}\right)^{2/3} (.0015)^{1/2}$$

$d = 11.3$ FT (NORMAL DEPTH)

Job No. 10841-001-141 | No.

HDR Computation

HDR

Project UPPER PENITENCIA CREEK | Computed CST | Date 6-13-01

Subject SINGLE BOX BYPASS | Checked | Date

Task CHARACTERISTIC HYDRAULIC VALUES | Sheet 2 | Of 2

AT NORMAL DEPTH

$A = 11.3 \text{ FT} \times 28 \text{ FT} = 316.4 \text{ FT}^2$

$V = Q/A = 4140 \text{ CFS} / 316.4 \text{ FT}^2 = 13.08 \text{ FT/S}$

$$F = \frac{V^2}{g d_n} = \frac{(13.08 \text{ FT/S})^2}{(32.2 \text{ FT/S}^2)(11.3 \text{ FT})} = 0.47 \text{ (FROUDE NUMBER)}$$

CRITICAL VELOCITY

$$V_c = \frac{Q}{(W)(d_c)} = \frac{4140 \text{ CFS}}{(28 \text{ FT})(8.79 \text{ FT})} = 16.82 \text{ FT/S}$$

MINIMUM ENERGY

$E_{MIN} = 1.5\, y_c = (1.5)(8.79 \text{ FT}) = 13.79 \text{ FT}$

CRITICAL SLOPE

$$S_c = \left(\frac{g_n n^2}{(1.49)^2}\right)\left(\frac{A}{b \cdot R_n^{2/3}}\right)$$

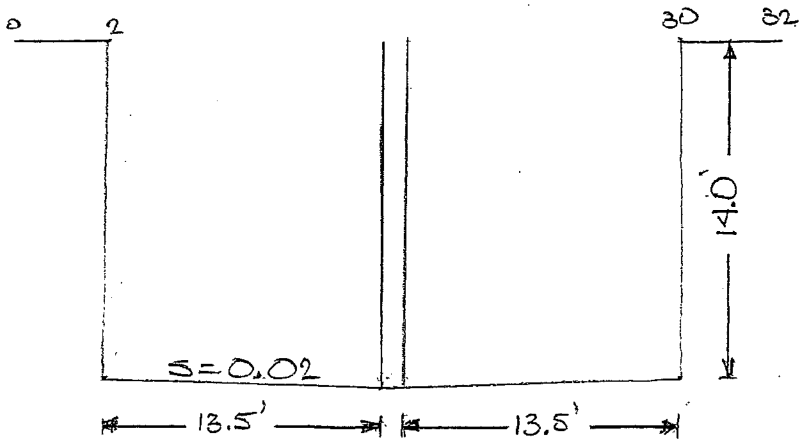
$$S_c = \left[\frac{(32.2)(.015)^2}{(1.49)^2}\right]\left[\frac{(28 \text{ FT})(11.3 \text{ FT})}{\left[(28 \text{ FT})\left(\frac{28 \text{ FT} \times 11.3 \text{ FT}}{2 \times 11.3 \text{ FT} + 28 \text{ FT}}\right)\right]^{4/3}}\right]$$

$S_c = .003$

Job No. 10841-001-141 No.

HDR Computation

Project	UPPER PENITENCIA CREEK	Computed JB	Date 08-23-01
Subject	DOUBLE BOX TYPICAL XS	Checked	Date
Task	CHARACTERISTIC HYDRAULIC VALUES	Sheet 1	Of 3



$n = .014 \qquad Q = 4140 \text{ CFS}$

$S = 0.003$

$$q = \frac{4140 \text{ CFS}}{27 \text{ FT}} = 153.3 \text{ CFS/FT}$$

$$Y_c = \sqrt[3]{\frac{q^2}{g}} = \sqrt[3]{\frac{(153.3 \text{ cfs})^2}{32.2 \text{ FT/S}^2}} = \underline{9.0 \text{ FT}} \quad \text{CRITICAL DEPTH}$$

$$E_{MIN} = \tfrac{3}{2} Y_c = 13.50 \text{ FT}$$

$$Q = \frac{1.49}{n} A R^{2/3} S^{1/2} = \frac{1.49}{n} (Wd) \left(\frac{Wd}{2d + W} \right)^{2/3} S^{1/2}$$

$$4140 = \frac{1.49}{.014} (27d) \left(\frac{27d}{2d + 27} \right)^{2/3} (.003)^{1/2}$$

$$\underline{d = 8.7 \text{ FT}} \quad \text{NORMAL DEPTH}$$

Job No. 10841-001-141

No.

HDR Computation

Project UPPER PENITENCIA CREEK	Computed JB	Date 08-23-01
Subject DOUBLE BOX TYPICAL XS	Checked	Date
Task CHARACTERISTIC HYDRAULIC VALUES	Sheet 2	Of 3

AT NORMAL DEPTH

$A = 8.7 \text{ FT} \times 27 \text{ FT} = 234.2 \text{ FT}^2$

$V = Q/A = \dfrac{4140 \text{ CFS}}{234.2 \text{ FT}^2} = 17.7 \text{ FT/S}$

$F_1 = \dfrac{V^2}{g d_n} = \dfrac{(17.7 \text{ FT/S})^2}{(32.2 \text{ FT/S}^2)(8.7 \text{ FT})} = 1.11$ FROUDE NUMBER

$F > 1 \rightarrow$ SUPERCRITICAL FLOW

THE CONJUGATE DEPTH TO d_n IS FOUND

$d_{n_2} = \dfrac{d_n}{2}\left(\sqrt{1+8F_1^2} - 1\right) = \dfrac{8.7 \text{ FT}}{2}\left(\sqrt{1+8(1.11)^2} - 1\right)$

$d_{n_2} = 9.98 \text{ FT}$

$A_2 = 9.98 \text{ FT} \times 27 \text{ FT} = 269.44 \text{ FT}^2$

$V_2 = Q/A = 4140/269.44 = 15.36 \text{ FT/S}$

$F_2 = \dfrac{V_2^2}{g d_{n_2}} = \dfrac{(15.36 \text{ FT/S})^2}{(32.2 \text{ FT/S}^2)(9.98 \text{ FT})} = .73$ FROUDE NUMBER

Job No. 10841-041-001
No.

HDR Computation

HDR

Project UPPER PENITENCIA CREEK	Computed JB	Date 08-23-01
Subject DOUBBLE BOX TYPICAL XS	Checked	Date
Task CHARACTERISTIC HYDRAULIC VALUES	Sheet 3	Of 3

CRITICAL VELOCITY

$$V_c = \frac{Q}{w\,d_c} = \frac{4140\ \text{CFS}}{(27_{\text{FT}})(9\,\text{FT})} = 17.04\ \text{FT/S}$$

MINIMUM ENERGY

$$E_{MIN} = 1.5\,Y_c = (1.5)(9.0\,\text{FT}) = 13.5\ \text{FT}$$

CRITICAL SLOPE

$$S_c = \frac{g_n n^2}{(1.49)^2}\left(\frac{A}{b \cdot R_h^{4/3}}\right)$$

$$= \frac{(32.2\,\text{FT/S}^2)(0.014)^2}{(1.49)^2}\left[\frac{(27\,\text{FT})\ (9.98\,\text{FT})}{\left[(27\,\text{FT})\left(\frac{27\,\text{FT} \times 9.98\,\text{FT}}{(2)(9.98\,\text{FT} + 27\,\text{FT})}\right)\right]^{4/3}}\right]$$

$$S_c = .001$$